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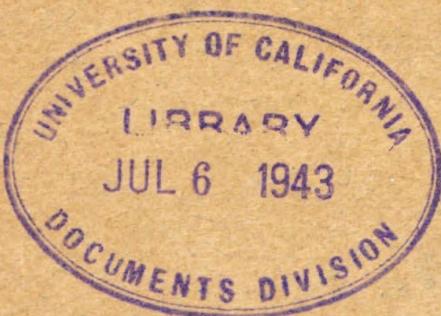
TECHNICAL MANUAL

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PNEUMATIC PONTON BRIDGE

M3

April 19, 1943



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TECHNICAL MANUAL
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PNEUMATIC PONTON BRIDGE, M3

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SECTION I

PURPOSE, COMPOSITION, AND ISSUE OF EQUIPAGE

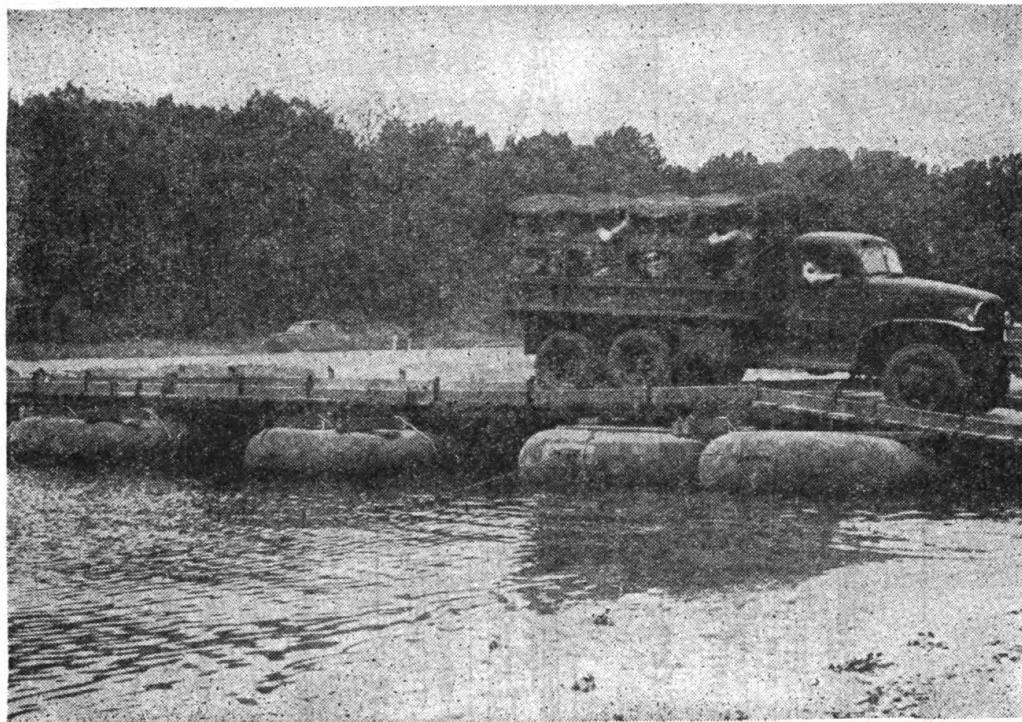
	Paragraph
Purpose -----	1
General design-----	2
Bridge unit-----	3
Issue -----	4

1. Purpose.—*a.* The pneumatic ponton bridge M3 (fig. 1) will support infantry division loads up to and including loaded 4-ton cargo trucks towing 155-mm howitzers. The reinforced bridge can carry approximately 18-ton tank loads if stream velocity is low and caution is observed. (See sec. VII.) Rafts can be constructed from materials in the bridge unit. A lightly reinforced three-float raft can carry the loaded 4-ton truck. A reinforced four-float raft can carry an 18-ton tank in low stream velocities. (See sec. VIII.)

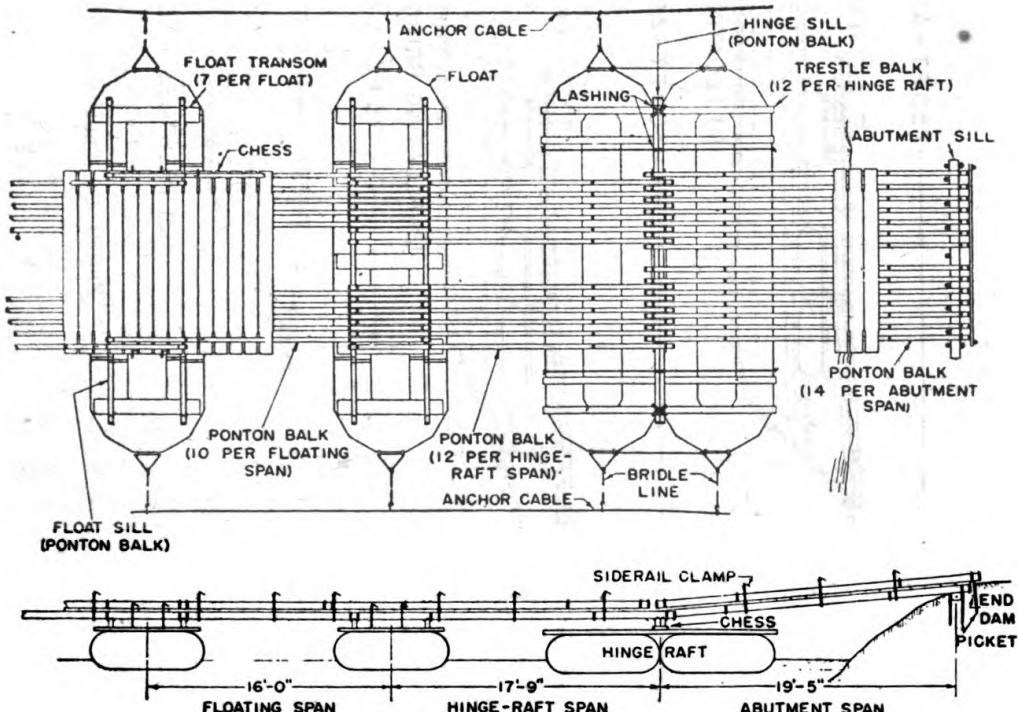
b. (1) Stream velocity materially affects bridge and raft capacity. Tentative capacities of the normal bridge in various currents are given in the following table:

Type of vehicle	Maximum stream velocity (mph)	
	Without close control	With close control ¹
2½-ton cargo truck (loaded)-----	4.0	4.5
2½-ton cargo truck (loaded) towing 105-mm howitzer-----	3.5	4.0
4-ton cargo truck (loaded)-----	3.0	3.5
4-ton cargo truck (loaded) towing 155-mm howitzer-----	1.6	2.6
4-ton cargo truck (loaded) towing 8-ton trailer (empty)-----	1.6	2.6

¹ Under close control vehicle speed must not exceed 2 mph and wheels should be kept close to downstream siderail.



① Floating bridge (without trestles).



② Plan and elevation of floating bridge (without trestles).

FIGURE 1.—Pneumatic ponton bridge M3.

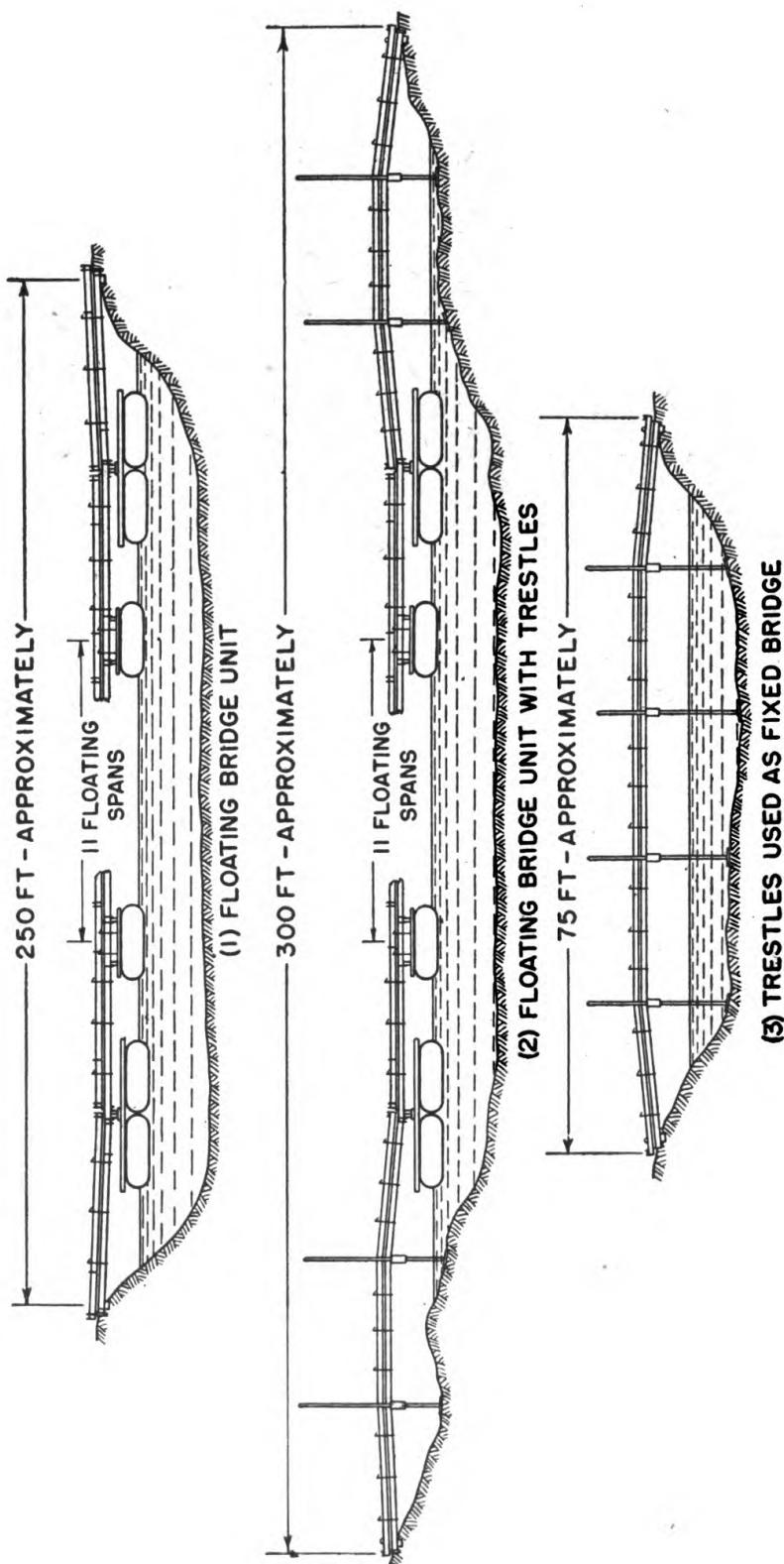


FIGURE 1.—Pneumatic ponton bridge M3—Continued.

(2) The fully reinforced bridge is unsafe for any vehicle when stream velocity exceeds 3.5 miles per hour. (See sec. VII.) Capacities of rafts are given in section VIII.

2. General design.—The pneumatic ponton bridge M3 consists of 10-ton ponton bridge type decking supported upon 12-ton pneumatic floats. (See fig. 1.) Whenever bank conditions permit, the normal bridge is built without trestles and ponton balk are used in all spans. There are 16-, 14-, and 12-ponton balk, including siderails, in the abutment, hinge-raft, and normal floating spans respectively (fig. 1②). For use of trestles, see section VI.

3. Bridge unit.—One unit of bridge provides approximately 250 feet of floating bridge (211 feet between hinge sills) and approximately 75 feet of trestle bridge (fig. 1③). The principal components of one bridge unit are forty 12-ton floats, four trestles, balk and chess decking, and supplementary equipment.

4. Issue.—Two units of pneumatic ponton bridge M3 are issued to each light ponton company.

SECTION II

DESCRIPTION OF FLOATING EQUIPAGE

	Paragraph
Float	5
Float transom	6
Float and hinge sills	7
Abutment sill	8
Balk	9
Chess	10
Siderail clamps	11
Balk connectors	12

5. Float.—The 12-ton pneumatic float (fig. 2) is 25 feet long, $7\frac{1}{2}$ feet wide, and 30 inches deep. It is made of rubberized fabric and consists of an outer tube, a floor, and a removable central tube. The central tube adds to the rigidity of the float and maintains buoyancy when the float is submerged. Each tube is 30 inches in diameter and is divided by bulkheads into separately inflated air chambers. Inflation pressure should not exceed $1\frac{1}{2}$ pounds per square inch. Attachments consist of straps for holding float sills to the float, straps to hold the central tube in place, D-rings for carrying the float and for attaching lashings and bridle lines, and a life line, which must *not* be used for carrying the float. The float weighs approximately 525 pounds. It has a buoyancy of approximately 17,000 pounds with a 9-inch free-board, or of approximately 24,000 pounds when floating with no free-board. When the float is submerged and water fills the space between

the center and outer tubes, buoyancy is reduced to approximately 21,000 pounds.

6. Float transom.—Float transoms are wooden planks 3 inches by 12 inches by 7 feet. Seven float transoms are placed across each single float to distribute over the float the load from the float sills (fig. 3).

7. Float and hinge sills.—*a.* Float sills are 10-ton ponton balk (par. 9). Two float sills are placed across the float transoms on each float to receive the decking load (fig. 3).

b. The hinge sill on the hinge raft consists of a chess and two ponton balk placed together and supported on two floats by twelve trestle balk laid across the floats (fig. 4).



FIGURE 2.—12-ton pneumatic float.

8. Abutment sill.—The abutment sill is a fir timber $5\frac{3}{4}$ inches by $7\frac{3}{4}$ inches by 13 feet, with metal rings at each end. A sill weighs approximately 135 pounds.

9. Balk.—*a. Ponton balk.*—A 10-ton ponton balk is a fir timber 4 inches by 6 inches by 21 feet 5 inches, which weighs approximately 140 pounds. Ponton balk are used in the floating bridge as float and hinge sills, as stringers, and as siderails.

b. Trestle balk.—A 10-ton trestle balk is a fir timber 4 inches by 6 inches by 15 feet $4\frac{3}{8}$ inches, which weighs approximately 100 pounds. Trestle balk are used as stringers and siderails in the trestle and hinge spans when trestles are used in the bridge, and are used as transoms on the hinge raft (fig. 4).

10. Chess.—A chess is a fir plank $2\frac{1}{8}$ inches by $11\frac{7}{8}$ inches by 12 feet, which weighs approximately 75 pounds. Chess are used as flooring.

11. Siderail clamps.—A siderail clamp is a C-shaped clamp weighing about 10 pounds. It engages the siderail and the outside

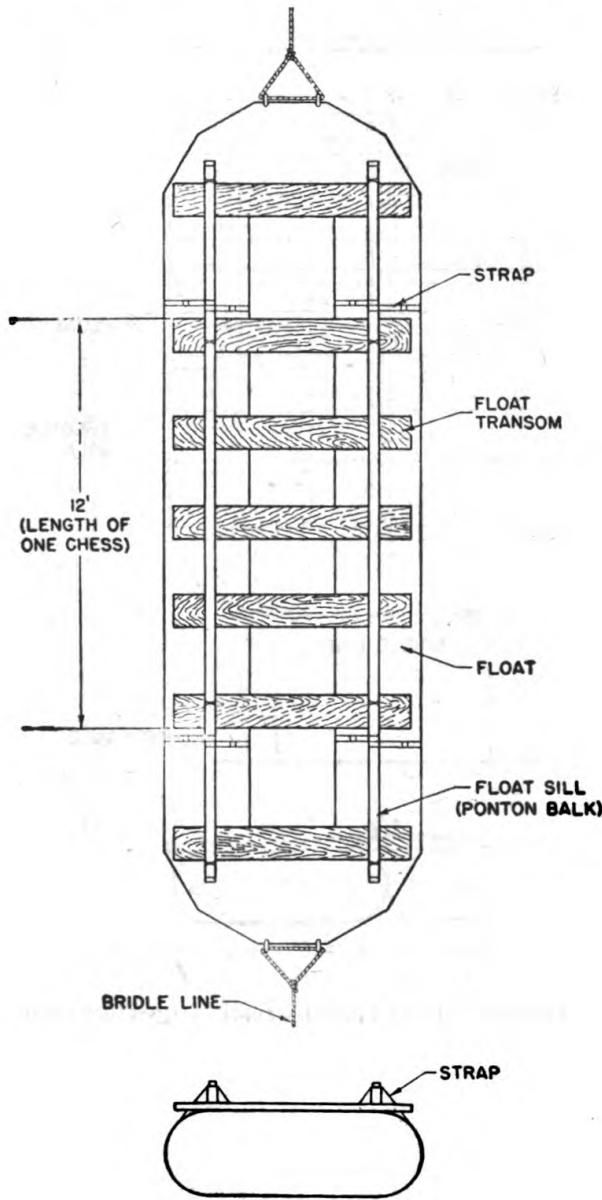


FIGURE 3.—Float assembly.

balk below the siderail, holding the siderail and chess firmly in place. Siderail clamps are also used to secure the chess to the float transoms (fig. 1②), and when so used are designated as float clamps.

12. Balk connectors.—A balk connector is a prefabricated box-like metal attachment which weighs approximately 70 pounds and

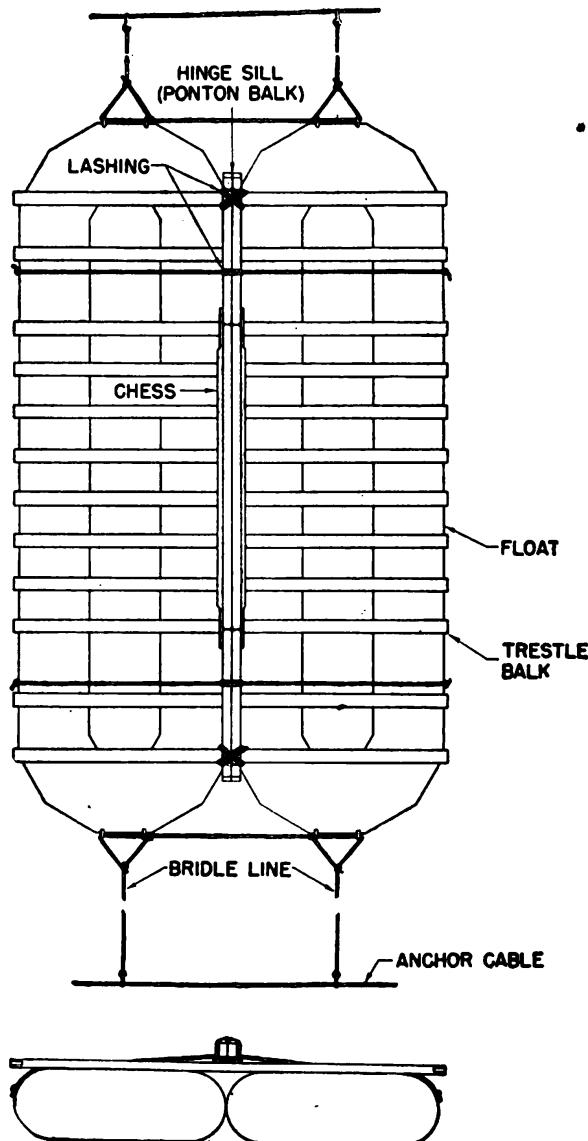


FIGURE 4.—Hinge-raft assembly.

is used to rigidly connect two trestle balk together end to end. It is used in the construction of rafts (sec. VIII).

SECTION III

SELECTION OF PNEUMATIC BRIDGE SITE

	Paragraph
General.....	13
Technical requirements.....	14

13. General.—The selection of a bridge site is governed by both technical and tactical requirements. Selection should be preceded by a thorough study of the tactical plan, maps, and aerial photographs,

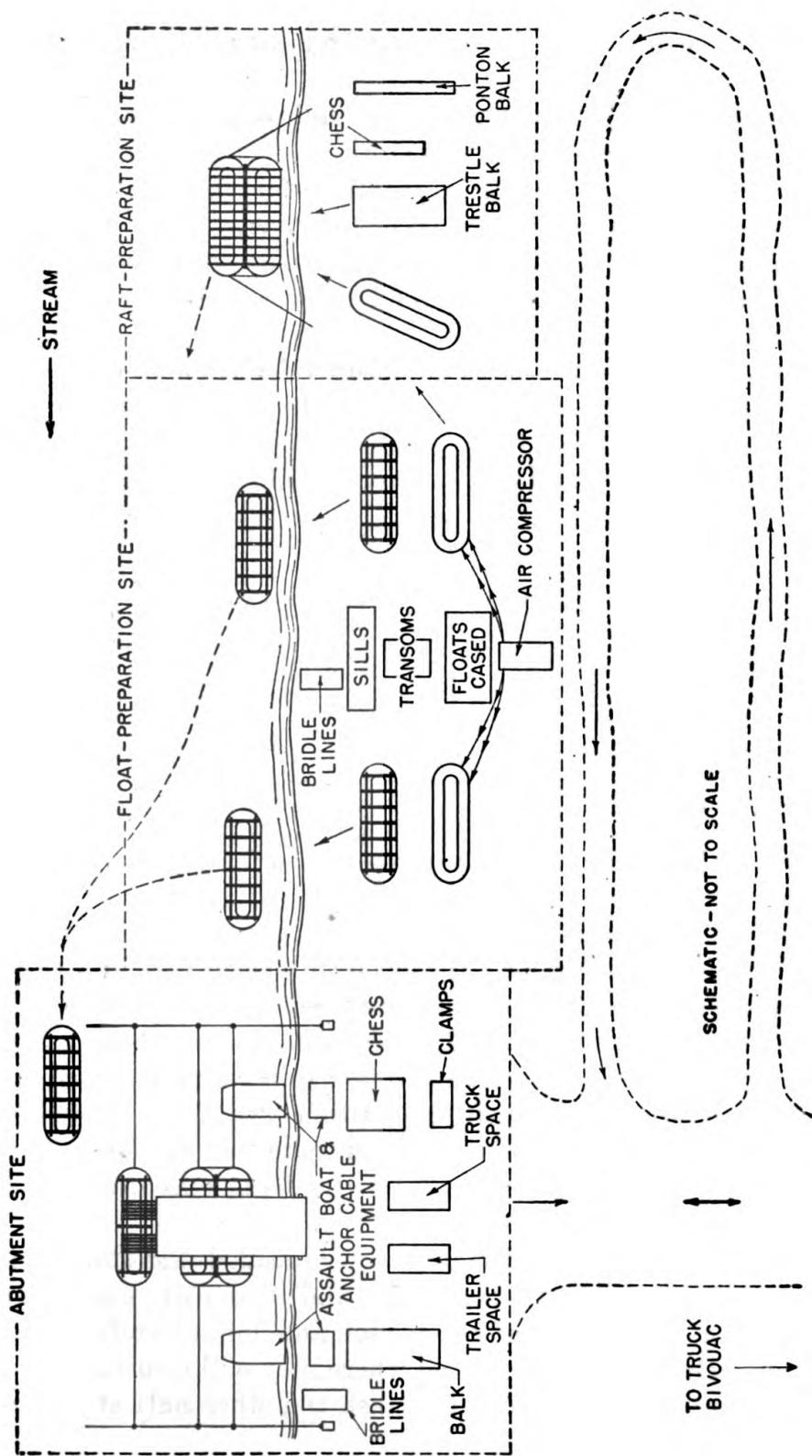


FIGURE 5.—Schematic lay-out of bridge site.

and finally by personal reconnaissance of the ground. For tactical requirements see FM 5-6. Technical requirements for the pneumatic bridge site are such that the bridge may be built under widely varied conditions of terrain.

14. Technical requirements.—The following technical factors are desirable for a pneumatic bridge site:

a. Approaches.—Minimum time required for construction of approach-road connections on both sides of the river.

b. Bed and banks.—River clear of rocks, snags, or projections that could puncture floats. Banks should be low and not require much clearing and grading.

c. Float-launching sites.—Area to be used for launching assembled floats should be clear of sharp projections which might damage floats ashore or in water.

d. Hold-fasts.—Trees suitable for use as hold-fasts for the cables.

SECTION IV

PREPARATION OF SITE AND UNLOADING OF EQUIPAGE

	Paragraph
General	15
Abutment site	16
Floatpreparation site	17
Raftpreparation site	18
Traffic circulation	19

15. General.—*a.* The approach road should be constructed and the bridge site prepared and cleared prior to the arrival of bridge equipage.

b. The site lay-out must be adjusted to fit the terrain and to meet the requirements of cover, concealment, and dispersion imposed by the particular tactical situation. Figure 5 shows an ideal site arrangement. It provides an approach road direct to the abutment, a cleared abutment site, clear float and raft preparation sites, and a turn-around.

16. Abutment site.—*a.* The abutment site requires space for the abutment, for unloading trucks and trailers, and for stacking equipment.

b. Balk, chess, and siderail clamps are unloaded and stacked near the head of the bridge. Anchor cables and accompanying equipage are unloaded at either side of the bridge and immediately prepared for erection. Bridle lines are placed where they will be used; one-half at the downstream anchor-cable holdfast, the other half at the float-assembly point.

17. Float preparation site.—The float preparation site requires space for unloading cased floats, for stacking float sills and transoms, for float inflation, for assembly of floats, and for launching assembled floats.

18. Raft preparation site.—The raft preparation site requires space for unloading and stacking the twenty-four trestle balk, four

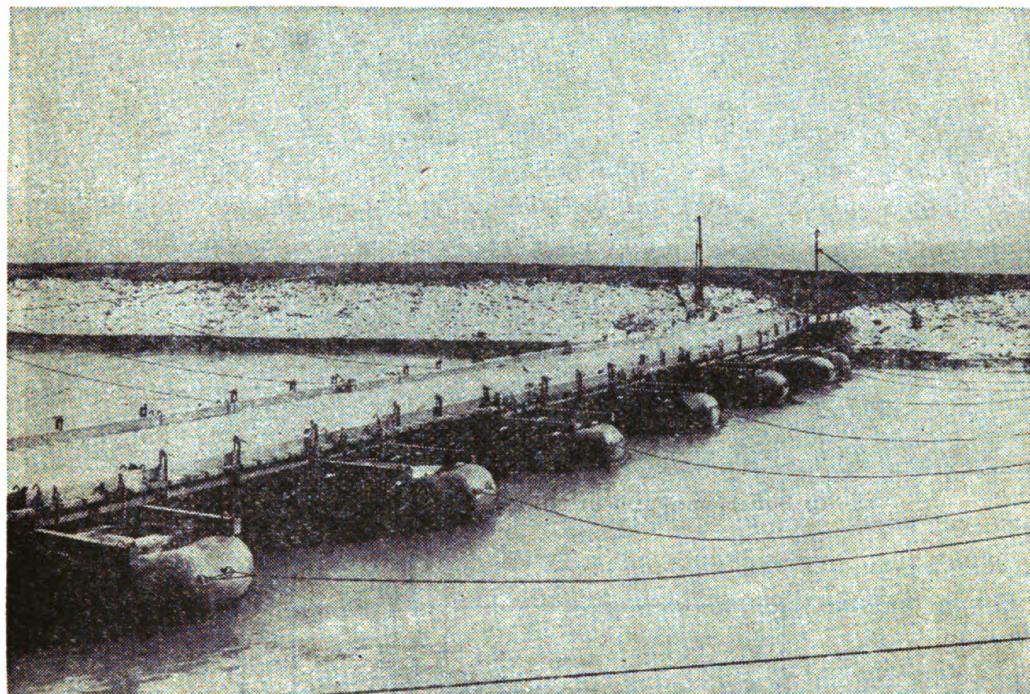
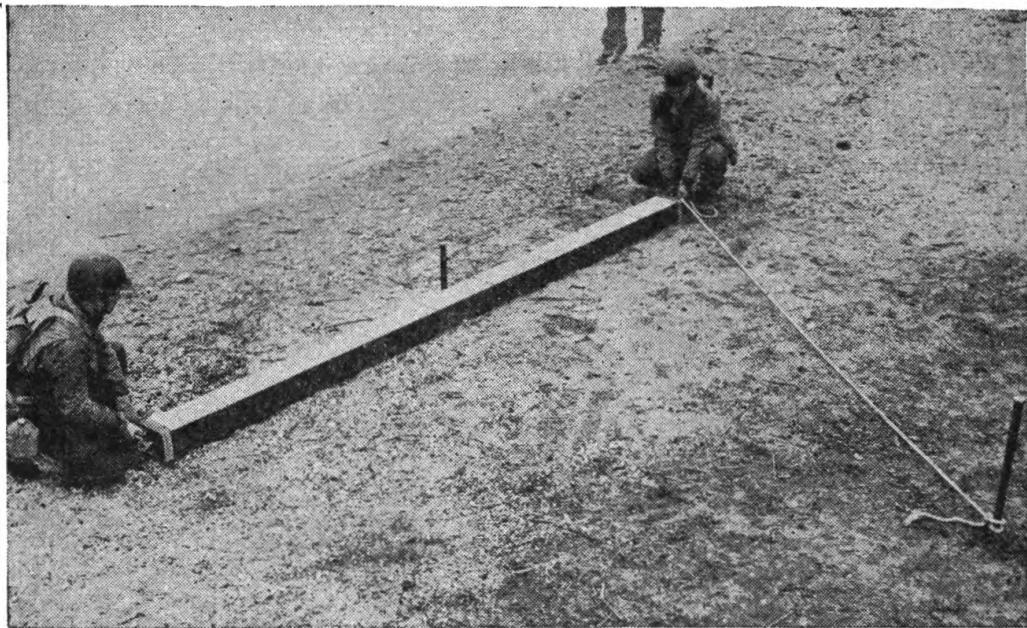


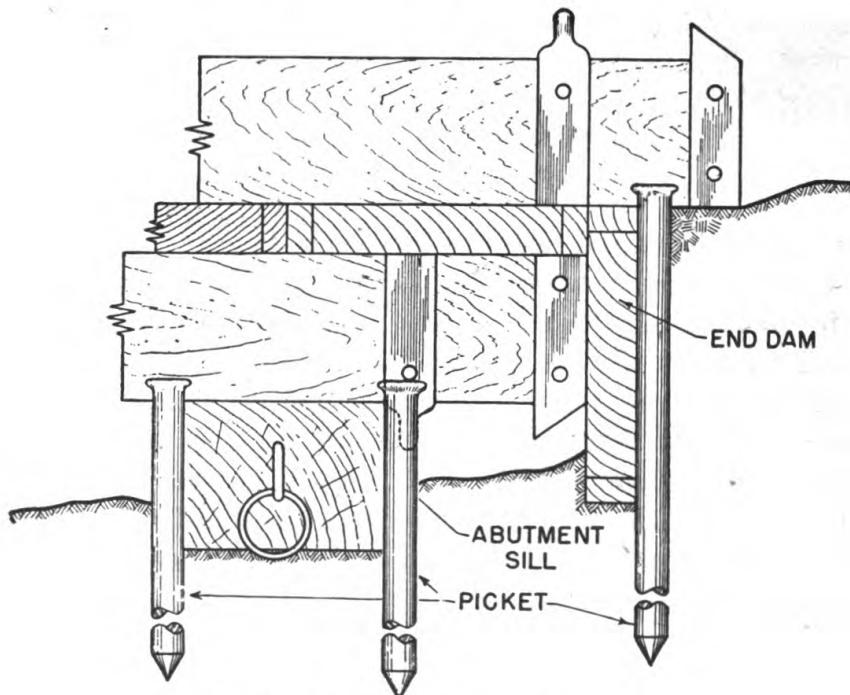
FIGURE 6.—Pneumatic ponton bridge M3 (with trestle).

ponton balk, two chess, and lashings necessary to construct two hinge rafts, for launching the four floats received from the float preparation site, and for assembling the rafts after the floats have been launched.

19. Traffic circulation.—Figure 5 shows the plan for traffic circulation during construction of the bridge. The air compressor should be located as shown. After trucks and trailers have been unloaded, they should be moved immediately to a truck bivouac that provides concealed cover near the site. Where space for stacking materials is not available at the site, the bridge may be built directly from the trucks and trailers.



① Squaring abutment sill on center line of bridge.



② Side elevation of completed abutment.

FIGURE 7.—Construction of abutment.

SECTION V

CONSTRUCTION OF BRIDGE

	Paragraph
General	20
Method of construction	21
Personnel	22
Upstream anchor-cable section	23
Downstream anchor-cable section	24
Abutment section	25
Float inflation section	26
Float carrier section	27
Balk carrier section	28
Chess section	29
Siderail section	30
River assembly section	31

20. General.—The standard method of constructing this bridge is by successive floats. Construction of each part of the bridge is described in paragraph 21. A suitable organization of personnel for training purposes is summarized in paragraph 22, and detailed duties of each section in that organization are given in paragraphs 23 to 31, inclusive. The break-down in paragraph 21, which describes construction procedure without reference to organization of personnel, may be used when it is impracticable to use the organization given in paragraph 22.

21. Method of construction.—The following table gives the procedure and equipment employed in construction of each part of the bridge by the method of successive floats:

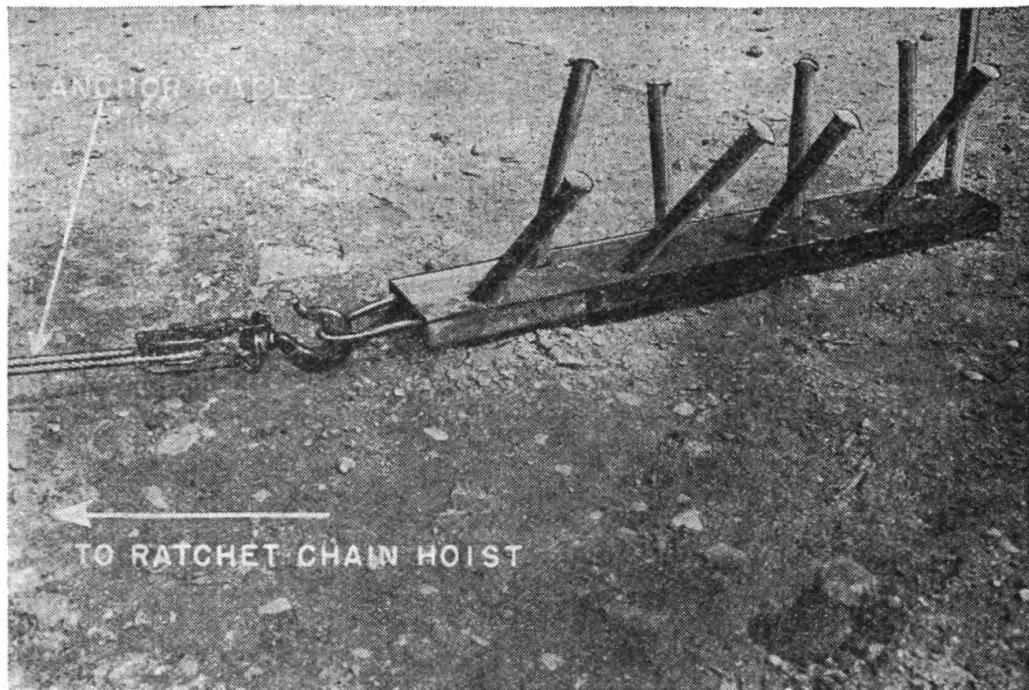
RANGES FOR BRIDGE ALINEMENT

<i>Task</i>	<i>Equipment</i>
Placement of ranging poles:	4 range poles

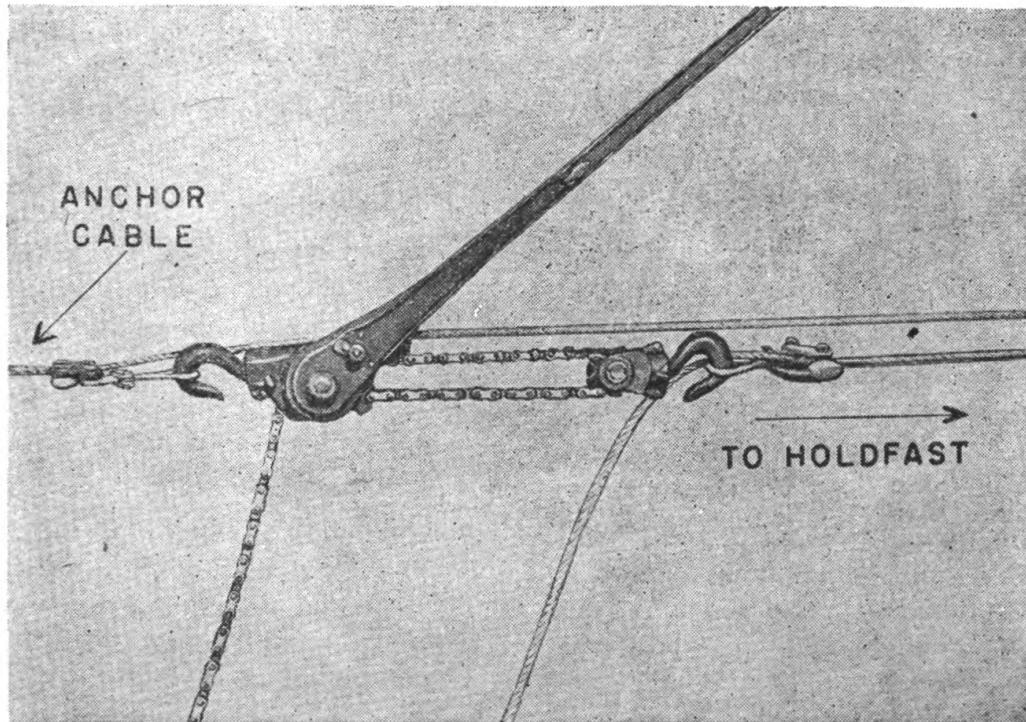
At each end of the bridge set up two range poles 25 feet apart on center line of bridge and two stakes 12½ feet on each side of center line (to align floats).

SHORE CONNECTION

<i>Task</i>	<i>Equipment</i>
Near-shore abutment construction:	
a. Center and square abutment sill by swinging tape (or lashing) from stake on center line to ends of sill (fig. 7①).	1 abutment sill 2 chess 13 pickets
b. Level ground for sill and end dam, allowing for projection of abutment-span balk beyond sill.	1 tape (or lashing) Sledges
c. Place sill and drive 11 pickets—nine on river side of sill between score marks on sill; two on shore side of sill.	Picks Shovels
d. After abutment-span balk have been laid, place end-dam chess with its top flush with top surface of first chess of decking, and drive one picket near each end of end dam (fig. 7②).	
e. Build up and tamp approach 1 inch above top of end dam.	
Far-shore abutment construction:	See above
Constructed in same manner as near-shore abutment. Equipment is crossed on far-shore hinge raft.	
Clearing stream bed:	
Stream bed under hinge rafts must be cleared of sharp objects which might injure floats.	Picks Shovels



① Anchor-cable hold-fast with cable attached.



② Ratchet chain hoist used to adjust anchor cable.

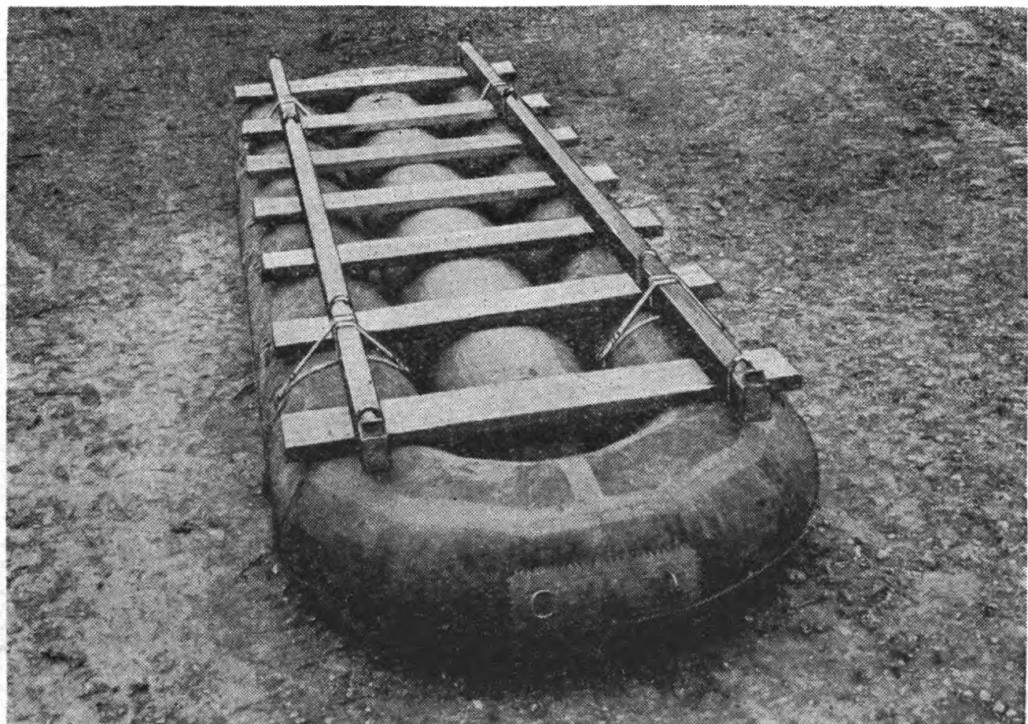
FIGURE 8.—Anchor-cable installation.

ANCHOR CABLES AND BRIDLE LINES

<i>Task</i>	<i>Equipment</i>
Upstream anchor-cable installation:	
a. Unload assault boat and equipment for upstream anchor cable.	1 assault boat M2 with 7 paddles in case 2 holdfasts with pickets
b. Launch and load assault boat; cross stream, paying out cable; construct far-shore hold-fast and attach cable to hold-fast through snatch block.	2 snatch blocks 1 anchor cable 6 cable clips
c. Hold near-shore end of cable as it is payed out from boat; construct near-shore hold-fast; attach cable to hold-fast through snatch block (fig. 8①).	2 cable grips 1 ratchet chain hoist Sledges
d. Tighten cable from near shore by means of cable grips and ratchet chain hoist (fig. 8②) until cable clears water.	Wrenches Lashings
Downstream anchor-cable installation:	
Same as upstream anchor cable.	See above
Maintenance of anchor cables:	
Maintain upstream and downstream anchor-cable hold-fasts (two men on each shore).	See above
Attachment of bridle lines:	
a. As floats pass downstream to bridge, upstream bridle lines on floats are attached to anchor cable.	1 bridle line per float
b. Downstream bridle lines are attached to downstream anchor cable and free ends are delivered by assault boat to floats at the bridge.	1 bridle line per float 1 assault boat M2 with 7 paddles in case
Centering of floats:	
a. As floats are added to bridge, they are centered approximately by adjusting bridle lines.	
b. When bridge is completed, bridle lines are readjusted. (Do <i>not</i> tighten anchor cables to align bridge; it may cause hold-fast to pull out.)	



① Float being inflated.



② Float assembly.

FIGURE 9.—Construction of float assembly.

FLOATS

Task	Equipment
Float preparation: Obtain cased floats; remove from cases; unroll for inflation	Floats as required

Float inflation (fig. 9①):

Obtain cased floats; remove from cases; unroll for inflation.

Float inflation (fig. 91):

Attach manifolds to air-compressor hose; inflate floats to 1½ pounds per square inch. 1 air compressor
2 manifolds

a. Pressure tests.—Pressure is correct when float ceases to be soft but continues to yield slightly under hand pressure.

b. Order of releasing floats for assembly.—(1) Four floats for hinge rafts.

(2) **Floats for float assemblies.**

Construction of float assembly (fig. 9②):

a. Place seven float transoms across the float.

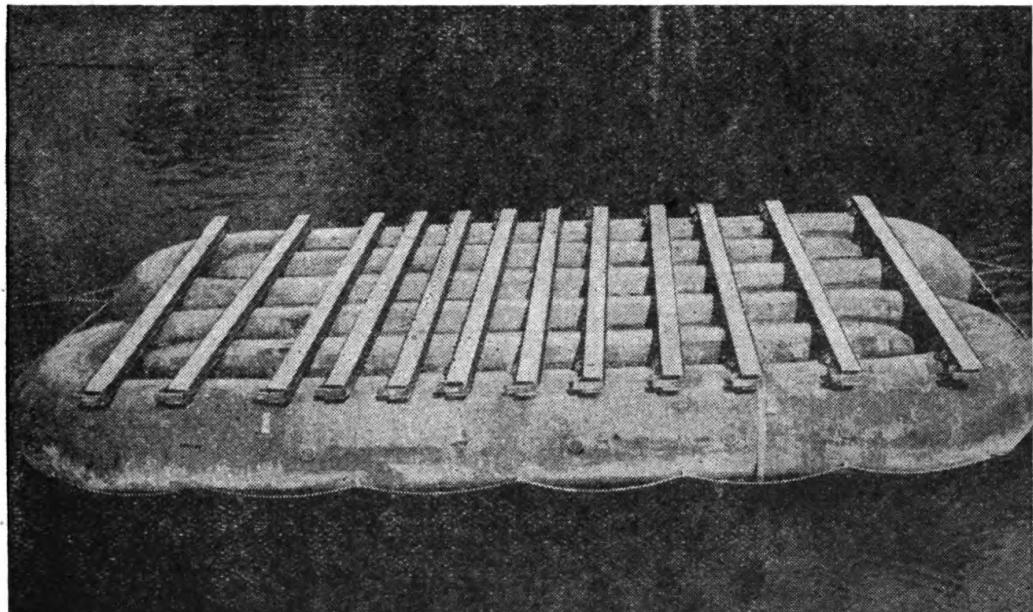
b. Place float sills across float transoms and strap to float.

c. Attach upstream bridle line.

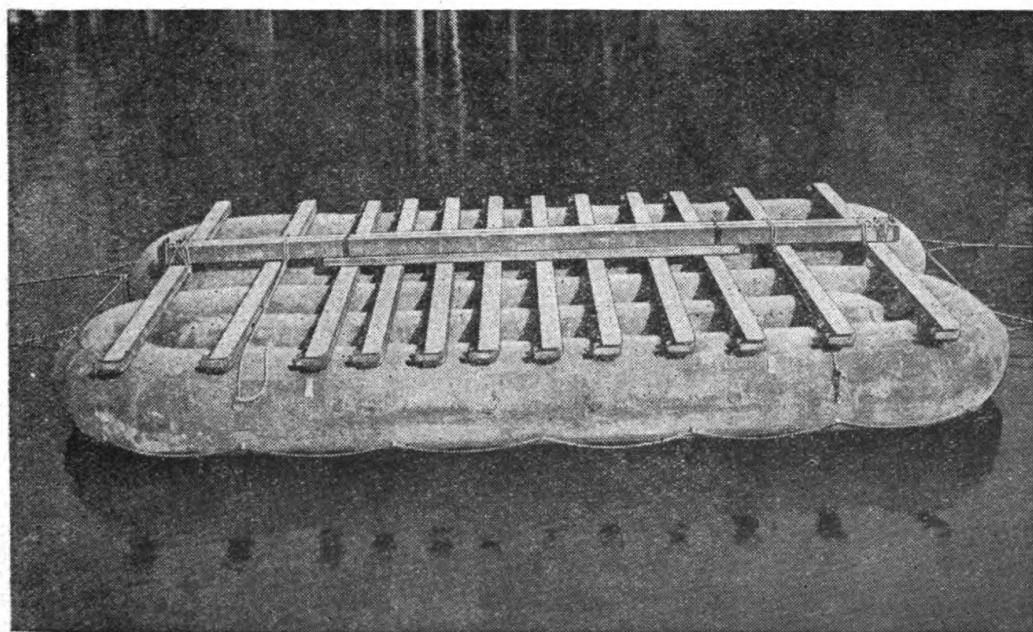
d. Release for launching.

1 air compressor
2 manifolds

7 float transoms per float
2 float sills per float
1 bridle line per float



① Hinge raft partly assembled.

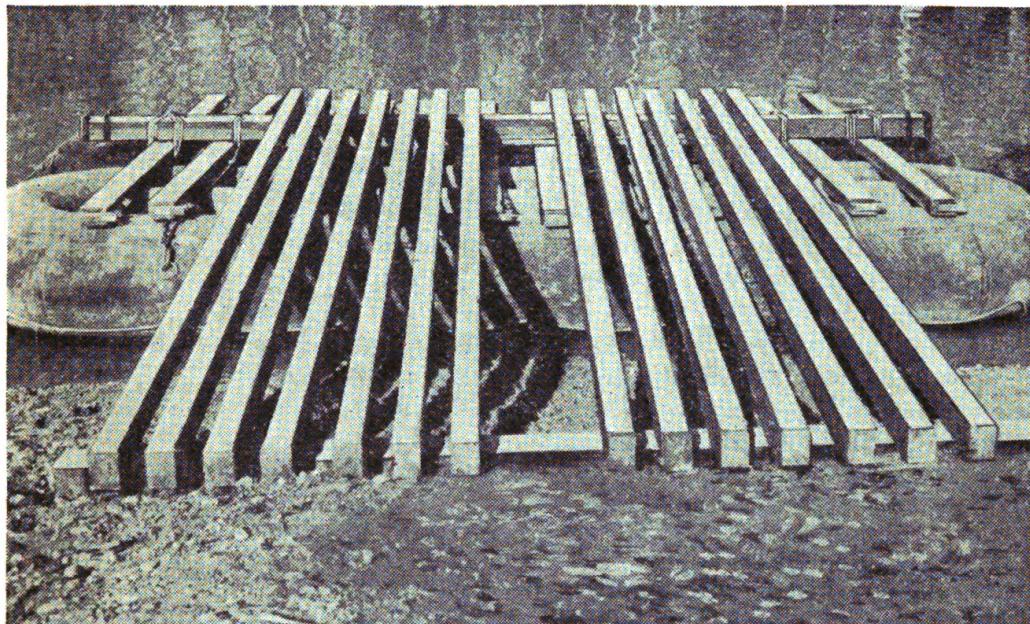


② Completed hinge raft.

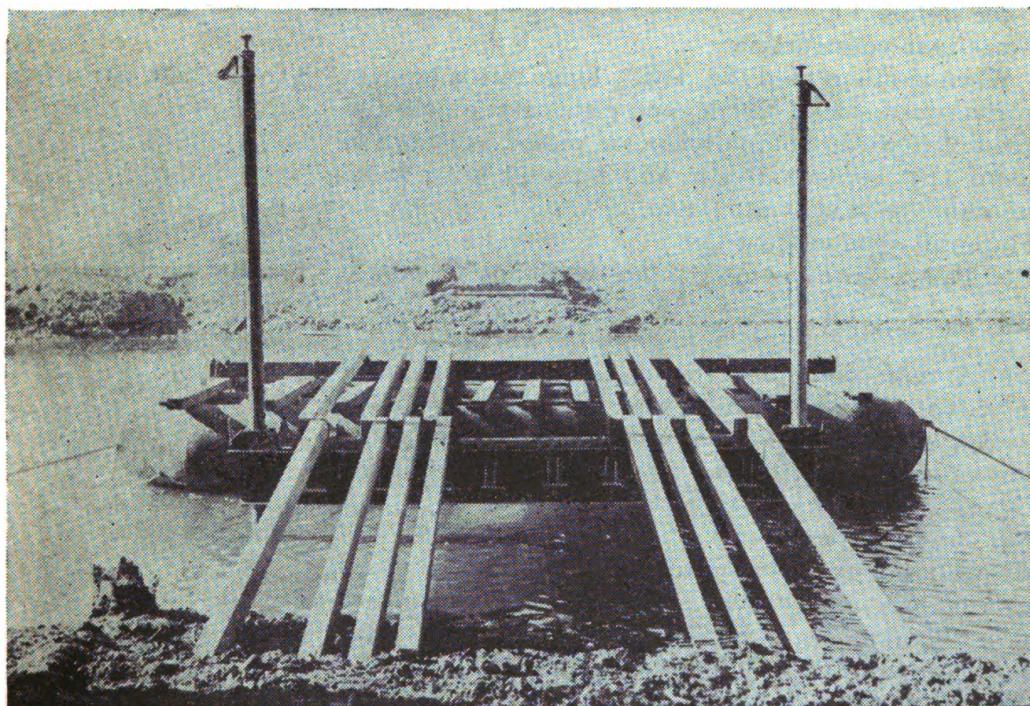
FIGURE 10.—Construction of hinge raft.

HINGE RAFTS

<i>Task</i>	<i>Equipment</i>
Near-shore hinge-raft construction:	
a. Launch, and lash together 2 inflated floats.	2 inflated floats
b. Place twelve trestle balk across floats as transoms (fig. 10①).	12 trestle balk (transoms)
c. Place sill made up of one chess and two ponton balk across the eight inner trestle balk, and lash sill in place to floats and to outer trestle balk (fig. 10②).	2 ponton balk (sill) 1 chess (sill) 4 lashings, 10-foot, $\frac{1}{2}$ -inch rope 2 lashings, 20-foot, $\frac{1}{2}$ -inch rope
d. Attach upstream-bridle lines.	2 bridle lines (upstream)
Far-shore hinge-raft construction:	
Same as near-shore hinge raft.	See above
Far-shore hinge-raft loading:	
Load far-shore hinge raft with equipment needed to construct far-shore abutment, skeleton far-shore abutment span, and (if trestle is used) far-shore trestle and skeleton hinge span.	1 abutment sill 2 chess 13 pickets 1 tape (or lashing) 2 ponton balk (if no trestle is used) If trestle is used: 4 trestle balk Trestle w/hoists Trestle bracing Lashings Tools



① Floating bridge without trestle—abutment-span balk in place.



② Floating bridge with trestle—abutment- and hinge-span balk in place.

FIGURE 11.—Location of balk from abutment to hinge raft.

SPANS

Task

Equipment

Abutment-span construction (fig. 11①):

a. Paddle near-shore hinge raft from raft preparation site to upstream anchor cable and attach upstream bridle lines to anchor cable.

Hinge raft

4 paddles

4 bridle lines (2 attached upstream end of raft;
2 delivered to raft at bridge)

b. Move downstream to bridge, receive free ends of downstream bridle lines from downstream anchor-cable section, and attach to raft. Center raft by adjusting bridle lines.

c. Pass riverward ends of seven odd-numbered balk to raft and lay on hinge sill; lift shoreward ends of balk and shove off hinge raft; place shoreward ends on abutment sill. Bring forward 7 even-numbered balk; pass riverward ends to raft by sliding balk, bottom side up, out over balk already in place; turn balk over into position.

14 ponton balk (stringers)

NOTE.—Far-shore abutment-span construction is the same as that of near-shore span, except that skeleton span of only two balk is laid. Remaining twelve balk are laid after bridge gap is closed.

Trestle spans:

See section VI.

Hinge-span construction:

When trestle is used (fig. 11②), hinge raft is brought to riverward side of trestle, and eight trestle balk (instead of fourteen ponton balk) are placed as shown in figure 11② between trestle and hingesill using same procedure as in abutment span.

8 trestle balk (stringers)

Hinge-raft-span construction:

a. Paddle float assembly to upstream-anchor cable.

1 float assembly with upstream bridle line attached

2 paddles

b. Attach upstream-bridge line to upstream-anchor cable (fig. 12); move float downstream to center line of bridge; receive downstream-bridge line delivered from downstream-anchor cable by assault boat; center float approximately by adjusting bridle lines.

12 ponton balk

c. Place riverward ends of six odd-numbered balk in correct positions on riverward sill of float; lift shoreward ends of balk; shove float assembly out into stream; place shoreward ends of balk on hinge-raft sill. Slide six even-numbered balk, bottom side up, out over balk already in place, and turn over into correct position (fig. 13).



FIGURE 12.—Attaching upstream bridle line to upstream anchor cable.

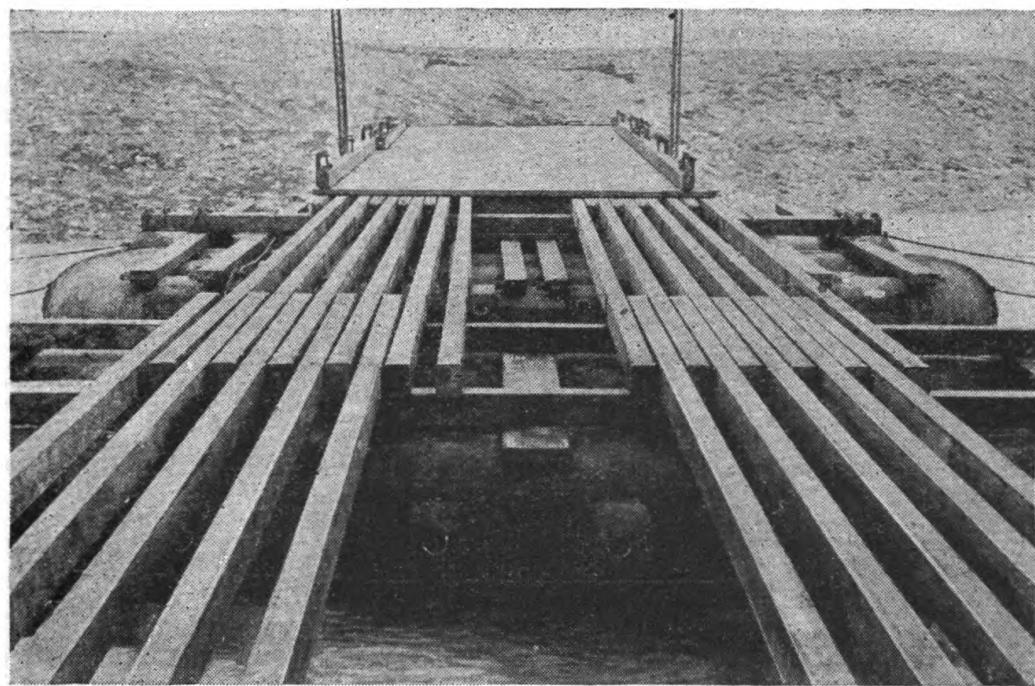


FIGURE 13.—Hinge-raft-span and normal-floating-span balk in place.

*Task**Equipment***Floating-span construction:**

Construction of floating spans is similar to construction of hinge-raft span, except that ten instead of twelve ponton-balk stringers are used (fig. 14).

Far-shore hinge-raft-span construction (closing the gap):

Far-shore hinge-raft span is constructed in same manner as near-shore hinge-raft span, except that to close bridge gap this span (or a floating span) usually must be shortened by allowing balk to overlap more than distance between sills on a single float (fig. 15).

Float assemblies as required to construct the bridge

Far-shore hinge raft 12 ponton balk (stringers)

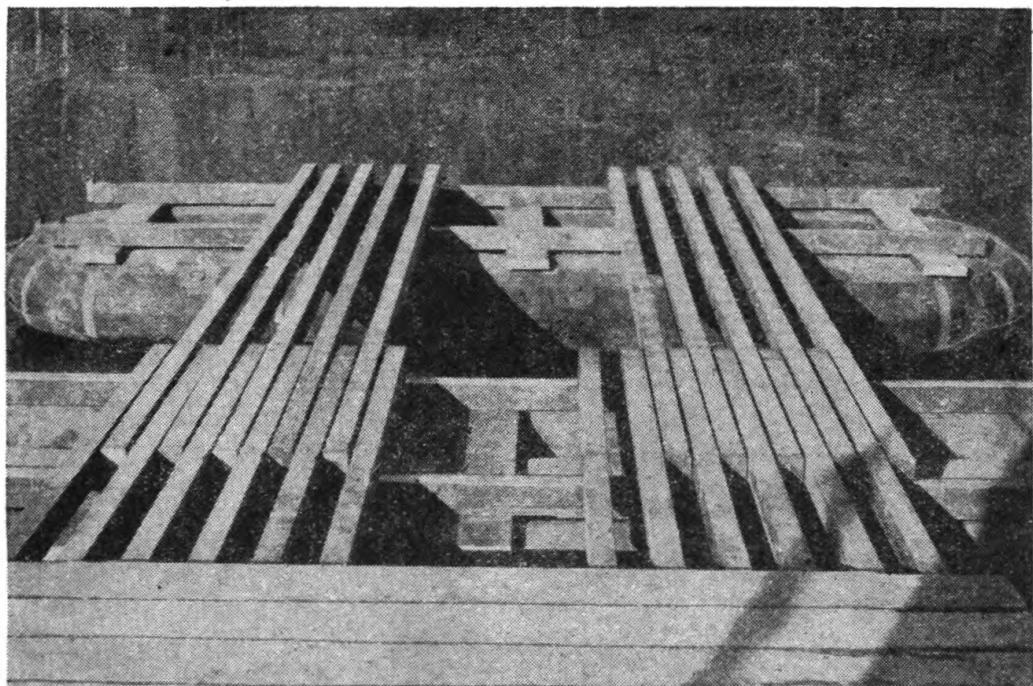


FIGURE 14.—Floating-span balk in place.

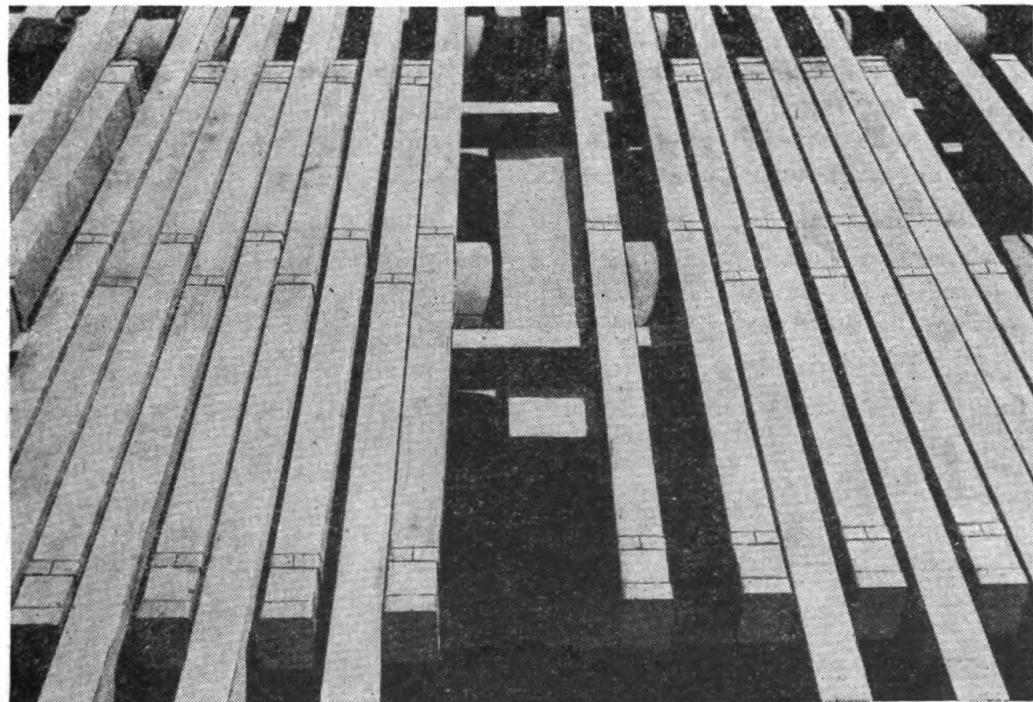
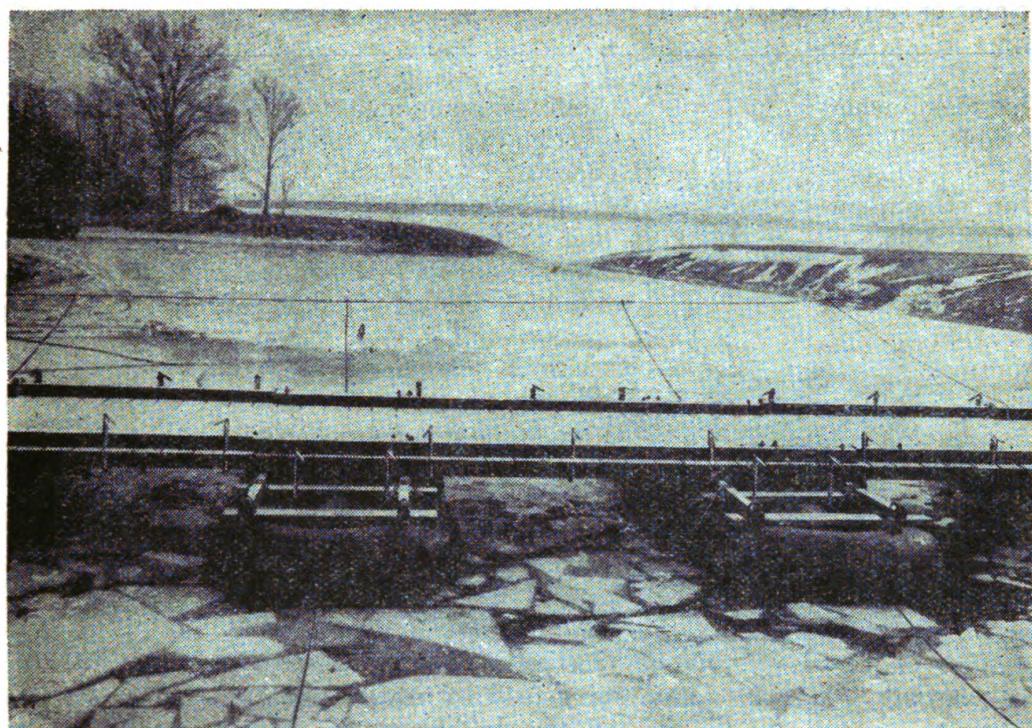


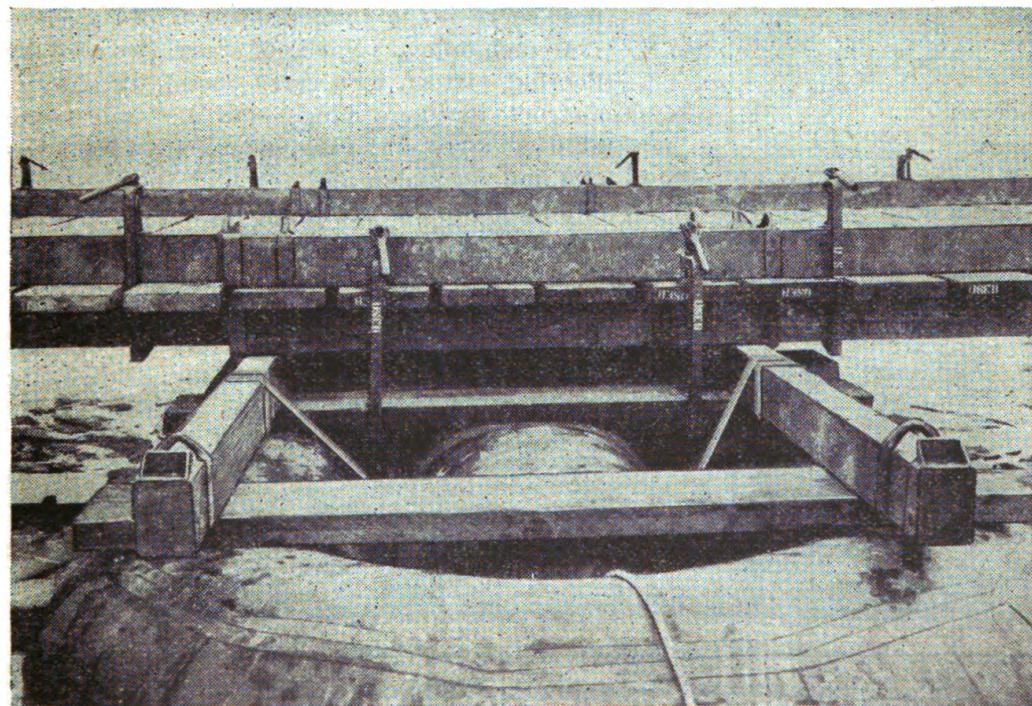
FIGURE 15.—Closing gap near far shore by allowing hinge-raft-span balk to overlap beyond riverward sill of float assembly.

SUPERSTRUCTURE

<i>Task</i>	<i>Equipment</i>
Balk (stringers):	
a. Balk are procured from stacks or vehicles and carried to bridge as required.	14 ponton balk per abutment span
b. Normally half the balk required in a span are placed at a time. Riverward ends of odd-numbered balk are passed out and laid on the appropriate riverward sill; shoreward ends are raised, shoved out, and placed in position; then even-numbered balk are slid out, bottom side up, over balk already in place, and turned over into position.	12 ponton balk per hinge-raft span
Chess (flooring):	
a. Chess carriers procure and carry chess from stacks or vehicles to bridge.	10 ponton balk per floating span
b. Chess layers on bridge receive and lay chess.	8 trestle balk per abutment and hinge span (if trestle is used).
Siderails:	
Balk siderails are placed on flooring over outer balk stringers.	21 chess per abutment span (15 if trestle is used)
Siderail clamps:	
a. In floating spans siderail clamps are placed in center of span and near each end of span on water sides of float sills (fig. 16).	17½ chess per hinge-raft span
b. In hinge-raft and abutment spans, clamps are placed approximately at quarter points of span.	16 chess per floating span
Float clamps:	
Above each float assembly each edge of decking is fastened by two siderail clamps to an underlying float transom (fig. 16②).	15 chess per hinge span (if trestle is used)
22. Personnel. —The following table shows a suggested working party to be used when trestles are not employed (for trestle section see par. 34) :	2 ponton balk per span (trestle balk in trestle spans)
	6 siderail clamps per span
	4 siderail clamps per float assembly (used as float clamps)



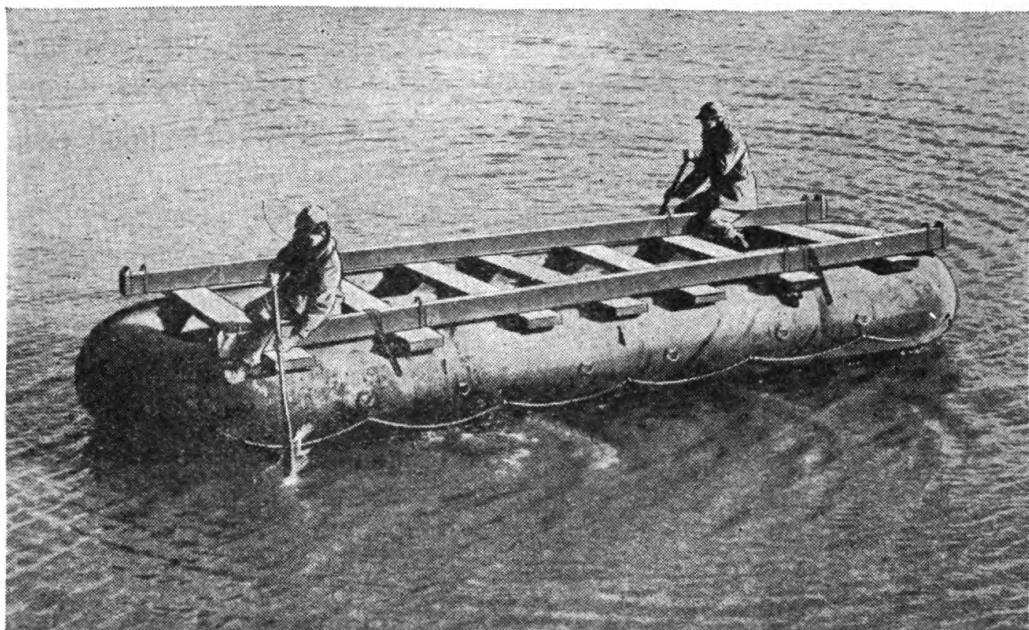
① Floating spans with siderail and float clamps in place.



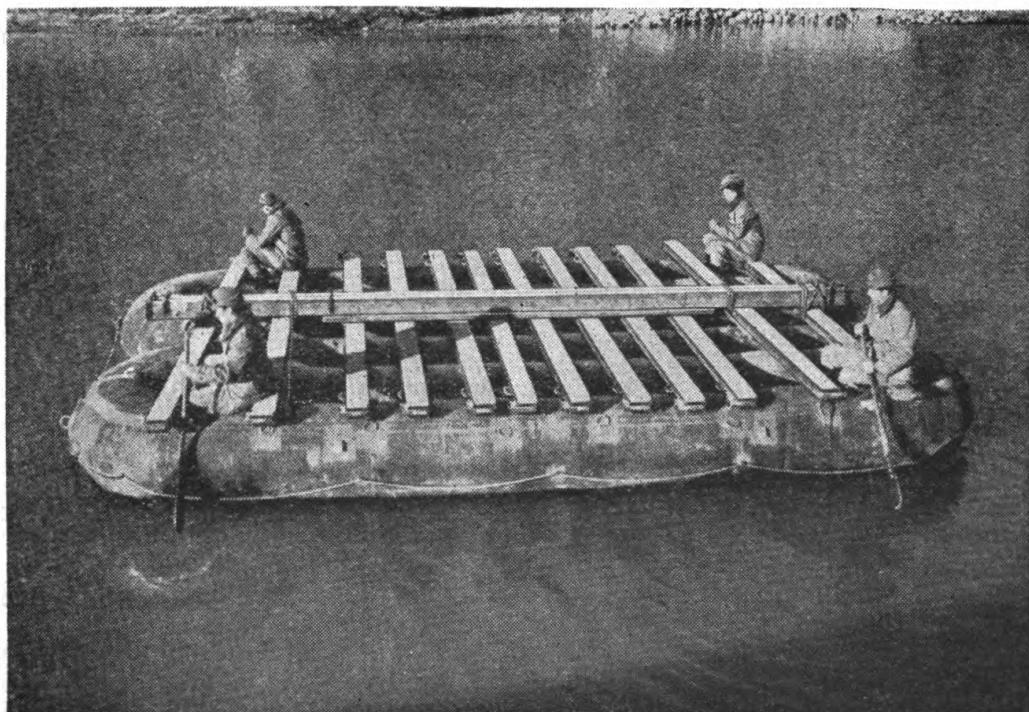
② Float clamps in place.

FIGURE 16.—Location of siderail and float clamps.

Name of section	NCO	Men	Duties
Upstream anchor-cable.	1	8	Install upstream anchor cable. Assist abutment section to clear stream bottom. Remove debris.
Downstream anchor-cable.	1	8	Install downstream anchor cable; maintain both anchor cables (four men); attach downstream bridle lines and deliver free ends to river assembly section (NCO and four men). Execute rescue work.
Abutment-----	1	8	Construct near-shore and far-shore abutments; clear stream bottom. Assist in erection of trestle and trestle-bracing anchor posts (if used).
Float inflation---	1	20	Prepare floats for inflation (four men); inflate floats (two four-man groups); construct float assemblies (two four-man groups).
Float carrier-----	1	16	Clear float launching site. Carry float assemblies and floats for hinge rafts to launching site and launch, as required by river assembly section.
Balk carrier-----	2	20	Carry balk to bridge; shove off hinge raft and float assemblies; place shoreward ends of balk in correct position on sills. Deliver balk for construction of far-shore hinge raft.
Chess-----	2	20	Procure materials (except floats) and construct near-shore hinge raft; procure and lay chess (two men unload vehicles or stack, two men lay flooring, sixteen men carry chess).
Siderail-----	1	8	Construct far-shore hinge raft and release to abutment section; place siderails; fasten siderail and float clamps.
River assembly--	1	11	Paddling group (six men); move near-shore hinge raft (four men) and float assemblies (two men each) to center line of bridge, attaching bridle lines to upstream-anchor cable; receive downstream-bridge lines from downstream anchorable section; adjust and make fast bridle lines; hold floats in position as balk are laid; return to float-launching site for next float assembly. Balk-laying group (NCO and five men): board near-shore raft; receive riverward ends of balk and place in correct position.
Total-----	11	119	



① Float assembly paddled by two-man crew of river assembly section.



② Hinge raft paddled by four-man crew of river assembly section.

FIGURE 17.—Movement of float assemblies and hinge raft to bridge.

23. Upstream anchor-cable section (one NCO and eight men).—*a. Duties.*—(1) Install upstream anchor cable.

(2) Assist abutment section to clear stream bottom.

(3) Remove debris.

b. Installation of upstream anchor cable.—(1) Equipment needed.

1 assault boat M2 with 7 paddles in case	1 ratchet chain hoist (near shore)
2 hold-fasts (1 on each shore)	Sledges, wrenches
2 snatch blocks (near and far shores)	2 range poles (far shore)
1 anchor cable on reel	2 stakes (far shore)
6 cable clips (3 on each shore)	2 anchors, Danforth
2 cable grips (near shore)	2 boat hooks
	1 lamp, portable electric lashings

(2) *NCO and six men.*—(a) Load upstream anchor-cable reel and far-shore equipment into boat.

(b) Proceed to far shore. NCO steers, two men hold reel and pay out cable, and four men paddle.

(c) NCO places far-shore range poles and stakes, and designates location of far-shore upstream anchor-cable hold-fast. Men prepare hold-fast and make cable fast.

(d) Assist abutment section to clear stream bottom.

(e) Remove debris, using assault boat.

(3) *Two men.*—(a) Remain on near shore.

(b) Hold end of upstream anchor cable as it is payed out from reel in boat.

(c) Prepare near-shore hold-fast and attach cable to hold-fast through snatch block.

(d) After cable has been made fast on far shore, tighten it from near shore by means of cable grips and ratchet chain hoist until cable clears water, and make fast.

(e) Proceed to far shore on far-shore hinge raft and assist abutment section.

NOTES

1. If upstream anchor cable is so high above water near the shore that river assembly section cannot attach upstream bridle lines from stream, two men remain on near shore to attach upstream bridle lines to cable and move lines on cable to stream where river assembly section picks them up as required (one per float).

2. If bridge is long and current is strong, upstream anchors (one per hinge raft and float assembly) are used instead of the upstream anchor cable, and are cast from the assault boat by the upstream anchor-cable section.

24. Downstream anchor-cable section (one NCO and eight men).—a. Duties.—(1) Install downstream anchor cable.

(2) Maintain both anchor cables.

(3) Attach downstream bridle lines to anchor cable and deliver free ends to river assembly section.

(4) Execute rescue work.

b. Installation of downstream anchor cable.—(1) Equipment needed.

1 assault boat M2 with 7 paddles in case	Bridle lines (1 per float)
2 hold-fasts (1 on each shore)	
2 snatch blocks (near and far shores)	
1 anchor cable on reel	2 life buoys
6 cable clips (3 on each shore)	1 boat hook
2 cable grips (near shore)	2 lashings, 10-inch
1 ratchet chain hoist (near shore)	
Sledges, wrenches	

(2) *NCO and six men.—(a) Load downstream anchor-cable reel and far-shore equipment into boat.*

(b) Proceed to far shore. (See par. 23b (2) (G).)

(c) Prepare far-shore hold-fast and make fast anchor cable.

(d) Two men remain on far shore to maintain anchor cables and make repairs or adjustments on far-shore hold-fasts.

(e) NCO and four men take boat; attach downstream bridle lines to downstream anchor cable; deliver free ends of downstream bridle lines to river assembly section; remain prepared to execute rescue work.

(3) *Two men.—(a) Remain on near shore.*

(b) Hold end of downstream anchor cable as it is payed out from reel in boat.

(c) Prepare near-shore hold-fast and attach cable to hold-fast through snatch block.

(d) After cable has been made fast on far shore, tighten it from near shore by means of ratchet chain hoist until cable clears water.

(e) Remain on near shore to make repairs or adjustments on near shore hold-fasts and anchor cables.

25. Abutment section (one NCO and eight men).—a. Duties.—

(1) Prepare near- and far-shore abutments.

(2) Assist in erection of trestle and trestle-bracing (if used).

(3) Clear stream bottom of sharp objects at location of hinge rafts, to prevent damage to floats.

b. Near-shore abutment construction.—(1) Equipment needed.

1 abutment sill

2 chess (end-dam and first chess of flooring)

13 pickets

1 tape (or lashing) for squaring sill

Sledges, picks, shovels

(2) *One NCO and eight men.*—(a) Square sill on center line of bridge and excavate level bed for sill and end dam.

(b) Drive eleven pickets to hold sill in place (nine on riverward face of sill and one near each end of shoreward face of sill).

(c) Assist in erection of trestle (if used).

(d) After abutment-span balk are in place, set one chess on edge flush against ends of abutment-span balk to form end dam.

(e) Adjust height of end dam so that upper edge is flush with surface of floor chess of abutment span. Drive one picket near each end of end dam to hold it in place.

(f) Backfill approach to one inch above bridge deck.

(g) Clear stream bottom of sharp objects.

c. Far-shore abutment construction.—(1) Equipment needed.—(a) For far-shore abutment: same as *b* above.

(b) For skeleton abutment span: two ponton balk (substitute four trestle balk, if trestle is used).

(c) For trestle (if used): trestle, trestle bracing, and tools.

(2) *One NCO and eight men.*—(a) Load tools and equipment on far-shore hinge raft (constructed by siderail section), procure paddles, and move across stream.

(b) Build far-shore abutment, construction being identical with that of near-shore abutment.

(c) Clear stream bottom of sharp objects.

(d) Assist in erection of far-shore trestle (if used).

(e) Place end-dam chess after balk of far-shore abutment span are in place.

(f) Backfill approach to 1 inch above bridge deck.

26. Float inflation section (one NCO and twenty men).—*a. Duties.*—(1) Prepare floats for inflation.

(2) Inflate floats.

(3) Construct float assemblies.

b. Float preparation (four men).—(1) *Equipment needed.*—Cased floats as required.

(2) *Four men.*—Obtain cased floats; remove floats from cases and unroll.

c. Float inflation (two groups of four men each).—(1) *Equipment needed.*

- 2 air compressors (1 attached)
- 2 manifolds

(2) *Each group of four men.*—(a) Inflates floats prepared by float preparation group to $1\frac{1}{2}$ pounds per square inch. (Test: pressure is correct when float ceases to be soft, but continues to yield slightly under hand pressure.)

(b) Releases floats for assembly in the following order:

- 1. Four floats for rafts.
- 2. Floats for float assemblies.

d. Construction of float assemblies (two groups of four men each).—(1) *Equipment needed* (per float).

- 7 float transoms
- 2 float sills (ponton balk)
- 1 bridle line (upstream)

(2) *Each group of four men.*—(a) Obtains equipment.

(b) Places float transoms across float and lays sills on float transoms.

(c) Straps sills to float.

(d) Attaches upstream bridle line to float.

27. Float carrier section (one NCO and sixteen men).—Duties:

a. Clear shore for launching.

b. Carry first four floats to raft preparation site, and launch them. Release first two to chess section and second two to siderail section.

c. Carry float assemblies to shore of float preparation site, launch them, and release to river assembly section.

28. Balk carrier section (two NCOs and twenty men).—*a. Duties.*—(1) Carry and place balk for far-shore hinge raft.

(2) Carry balk to bridge and place as required.

b. Carrying balk for fur-shore hinge raft.—(1) *Equipment needed.*

- 12 trestle balk
- 2 ponton balk (for hinge sill)
- 1 chess (for hinge sill)

(2) *Two NCOs and twenty men.*—(a) Obtain twelve trestle balk and place across hinge-raft floats.

(b) Deliver chess and two ponton balk for hinge sill.

c. Carrying balk to bridge.—(1) *Equipment needed.*—Balk as required.

(2) *Two NCOs and twenty men.*—(a) Obtain balk from stack or vehicles and carry to bridge as required. One NCO remains at stack or vehicles, other NCO supervises laying of balk at bridge.

(b) Pass riverward ends of odd-numbered balk to balk-laying group of river assembly section.

- (c) Shove off hinge raft or float assembly, as the case may be, by raising and pushing out shoreward ends of odd-numbered balk.
- (d) Place shoreward ends of odd-numbered balk.
- (e) Pass riverward ends of even-number balk to balk layers by sliding balk, bottom side up, over balk already in place, and turn balk into position.
- (f) Return to stack or vehicles to obtain balk for next span.

NOTE.—Use extra balk carriers to expedite construction on long bridges.

29. Chess section (two NCOs and twenty men).—*a. Duties.*—

- (1) Construct near-shore hinge raft, and release to river-assembly section.

- (2) Carry and lay chess.

b. Near-shore hinge-raft construction.—(1) *Equipment needed.*

2 inflated floats (delivered and launched by float-carrier section)

12 trestle balk (transoms)

2 ponton balk (sill)

1 chess (sill)

2 lashings, 20-foot, $\frac{1}{2}$ -inch rope

4 lashings, 10-foot, $\frac{1}{2}$ -inch rope

2 bridle lines (upstream)

- (2) *One NCO and eight men.*—(a) Obtain lashings and bridle lines.
- (b) Lash and strap floats together.
- (c) Assist in placement of trestle balk.
- (d) Place chess and two ponton balk for hinge sill across trestle balk and between floats.

- (e) Lash sill to outer trestle balk and to floats.

- (f) Attach upstream bridle lines to floats.

- (g) Moor to shore for release to river-assembly section.

- (3) *One NCO and twelve men.*—(a) Obtain 12 trestle balk and place across floats.

- (b) Obtain chess and two ponton balk for hinge sill.

c. Laying chess.—(1) *Equipment needed.*—Chess as required for flooring of bridge.

- (2) *One NCO (in charge) and two men.*—Take positions on balk of span to floored and facing near shore in such manner that chess may be received from carriers and laid quickly.

- (3) *One NCO and two men.*—Raise chess at stack or vehicles to facilitate handling by carriers.

- (4) *Sixteen men.*—Carry chess as directed by NCO in charge.

30. Siderail section (one NCO and eight men).—*a. Duties.*—

- (1) Construct far-shore hinge raft and release to abutment section.

(2) Place siderails; fasten siderail and float clamps.

b. *Far-shore hinge-raft construction.*—(1) *Equipment needed.*

2 inflated floats (launched by float-carrier section)

12 trestle balk

2 ponton balk } (delivered by balk-carrier section)

1 chess

2 lashings, 20-foot, $\frac{1}{2}$ -inch rope

4 lashings, 10-foot, $\frac{1}{2}$ -inch rope

2 bridle lines (upstream)

(2) *Eight men.*—(a) Obtain lashings and bridle lines.

(b) Lash and strap floats together.

(c) Assist balk carriers to place trestle balk across the two floats.

(d) Place chess and two ponton balk for hinge sill, across trestle balk and between floats.

(e) Lash sill to outer trestle balk and to floats.

(f) Attach bridle lines.

(g) Moor to shore ready for release to abutment section.

c. *Siderail construction.*—(1) *Equipment needed.*

2 Balk per span (used as siderails)

6 Siderail clamps per span

4 Siderail clamps per float assembly (used as float clamps)

(2) *Four men.*—Obtain and place siderails.

(3) *Four men.*—Obtain and fasten siderail and float clamps.

31. **River assembly section** (one NCO and eleven men).—a.

Duties.—(1) *Paddling detail* (six men): move floats to center line of bridge; attach bridle lines and aline floats.

(2) *Balk-laying detail* (one NCO and five men): place riverward ends of balk on successive floats.

b. *Float paddling* (six men).—(1) *Equipment.*—Paddles (one per man).

(2) *Six men* (two men per float).—(a) Receive near-shore hinge raft (four men) and float assemblies (two men per float) at launching sites.

(b) Paddle to upstream anchor cable and attach upstream bridle lines to anchor cable.

(c) Move downstream to center line of bridge.

(d) Receive downstream bridle lines from downstream anchor cable section and attach to floats. Adjust bridle lines so that floats are approximately on bridge center line. Hold floats in position as balk are laid.

(e) Return to float launching site for other floats.

NOTE.—1. If upstream anchor cable is so high above water near the shore that paddlers of river-assembly section cannot attach upstream bridle lines from

stream, two men of upstream anchor-cable section remain on near shore to attach bridle lines to cable and move lines on cable to stream where river assembly section picks them up as needed.

2. Increase number of paddlers per float if wind or current is strong.

c. *Balk laying* (one NCO and five men).—(1) *Equipment*.—None.

(2) *NCO and five men*.—(a) Board near-shore hinge raft (constructed by chess section).

(b) Receive riverward ends of odd-numbered balk from balk carriers and place in correct position on hinge sill of hinge raft or riverward sill of float assemblies, as the case may be.

(c) Hold down odd-numbered balk as hinge raft or float assembly is shoved out by balk carriers.

(d) Receive riverward ends of even-numbered balk from balk carriers, and place in correct positions on riverward sill.

(e) Move to next float as soon as paddlers deliver it to center line of bridge.

NOTE.—The bridge gap is closed by allowing far-shore hinge-raft span balk to overlap beyond riverward sill of float assembly.

SECTION VI

TRESTLE EQUIPAGE

Description	Paragraph
Employment of trestles	32
Personnel	33
Construction of trestles	34
	35

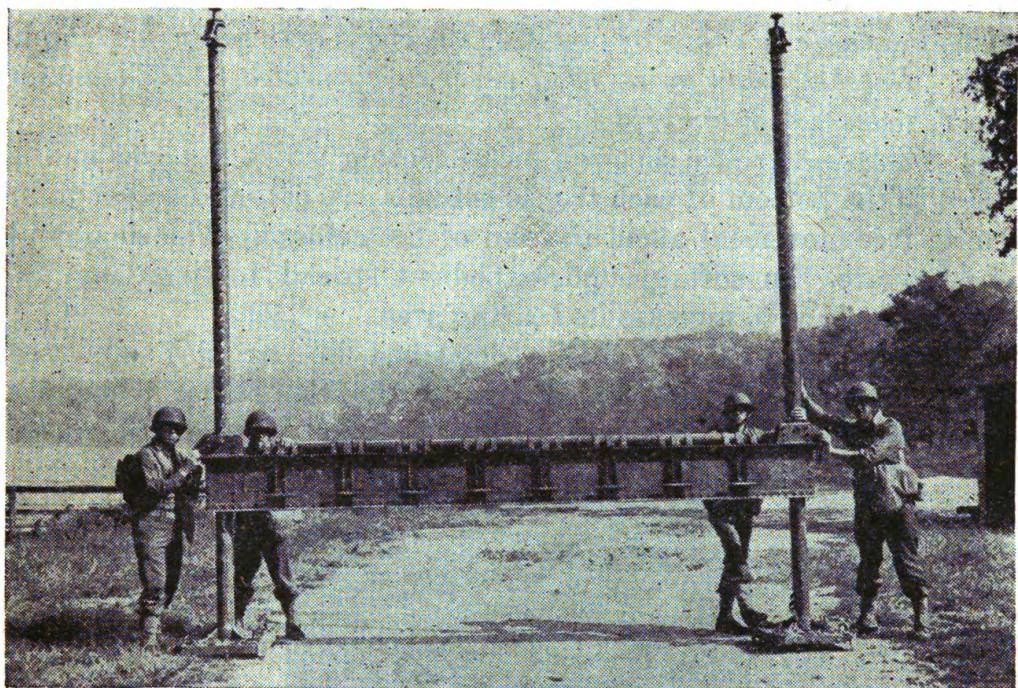
32. Description.—a. *General*.—The principal components of trestle equipment in the bridge unit are four trestles, necessary trestle balk, chess, siderail clamps, and a trestle-bracing set. This equipment is of the same type as that used in the 10-ton ponton bridge.

b. *Trestle*.—(1) A trestle consists of a transom, two columns, and two shoes (fig. 18), and weighs complete about 750 pounds.

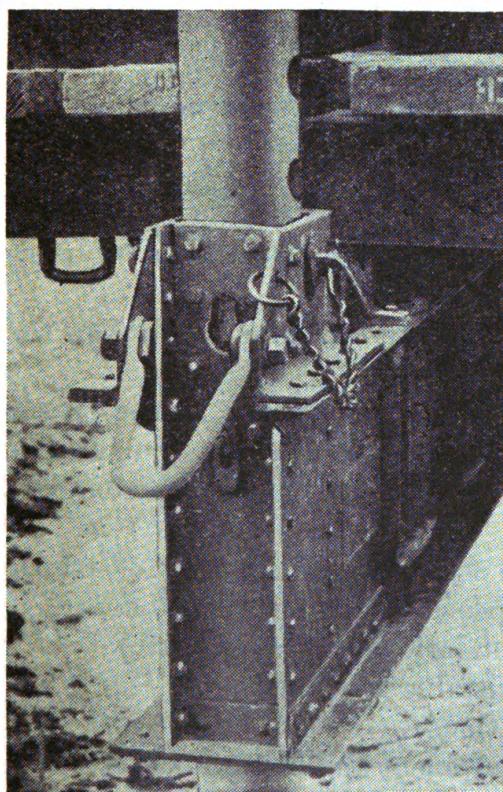
(2) *Transom*.—The transom is a built-up metal beam 13 feet, 10 inches long, 9 inches wide, and 15 inches deep. A steel tube along its top supports the U-shaped end-fittings of trestle balk. Cleats are provided for lashing trestle balk to the transom. Two pins for securing the transom on the columns are chained to each end of the transom.

(3) *Columns*.—Trestle columns are metal tubes $4\frac{1}{2}$ inches in diameter. They are inserted through each end of the transom and secured in place by pins. Vertically spaced holes in the columns and holes in the transom permit $1\frac{3}{4}$ -inch and $3\frac{1}{2}$ -inch adjustments in height of the transom (fig. 18②).

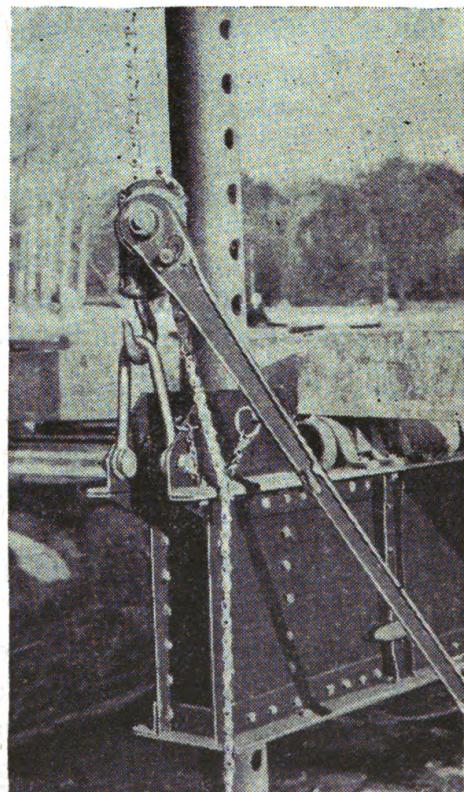
(4) *Chain hoists*.—Two ratchet chain hoists are employed for raising or lowering the trestle transom. A hoist has a load capacity of



① Trestle.



② Transom locked in place on column.



③ Ratchet chain hoist connected to transom.

FIGURE 18.—Details of trestle.

1½ tons, when a single chain connection is used (fig. 18③). Capacity may be increased to 3 tons by doubling the chain over to form a simple tackle. *Ratchet chain hoists must never be connected to the transom when vehicles are on the bridge.*

(5) *Shoes.*—A trestle shoe is a metal footing which fits over and is hooked to the bottom of each trestle column. A ball-and-socket joint permits free movement about the end of the column. The shoe is 24 inches square. In soft ground, expedient spread footings may be lashed to the shoe to increase its bearing area.

c. *Trestle balk.*—Trestle balk (described in par. 9b) are used as stringers and as siderails in all spans of trestle bridge. There are eight stringers and two siderails in each span of standard trestle

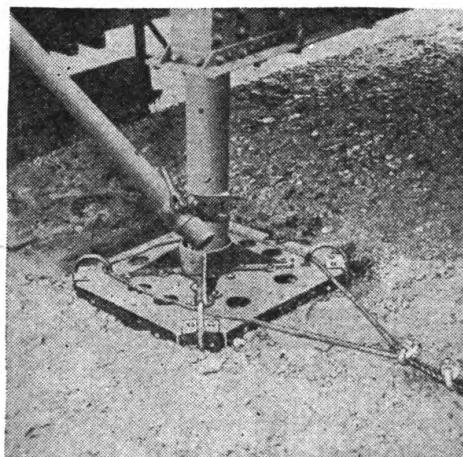


FIGURE 19.—Trestle shoe with bracing strut and anchor cable.

bridge; fourteen stringers and two siderails in each span of reinforced trestle bridge. (See sec. VII.)

d. *Chess.*—Chess in the trestle bridge are the same as chess in the floating bridge (par. 10).

e. *Trestle bracing.*—(1) Trestle-bracing equipment in the trestle bridge consists of sixteen bracing struts and strut shoes, four anchor posts, thirty-two column clamps, five hold fasts, and miscellaneous accessories.

(2) Trestle bracing increases the stability and capacity of trestle spans subjected to heavy traffic. Types of bracing employed are:

- (a) Tripod bracing (unstable foundations). (See fig. 20.)
- (b) Single diagonal bracing (semistable foundations).
- (c) Cross bracing (stable foundations).

(3) For a detailed discussion of equipment and of methods, erection, and maintenance of trestle bracing, see TM 5-273.

33. **Employment of trestles.**—Whenever possible, the pneumatic ponton bridge M3 is constructed without trestles. Trestles are used to—

a. Provide a fixed bridge. The trestle equipage in the bridge unit provides 75 feet of fixed bridge, consisting of three trestle spans and two abutment spans, each 15 feet long.

b. Provide an approach to the bridge where shore conditions prevent the use of floats. Where the water is shallow and grounding of floats cannot be permitted on account of an uneven, sloping, or rough

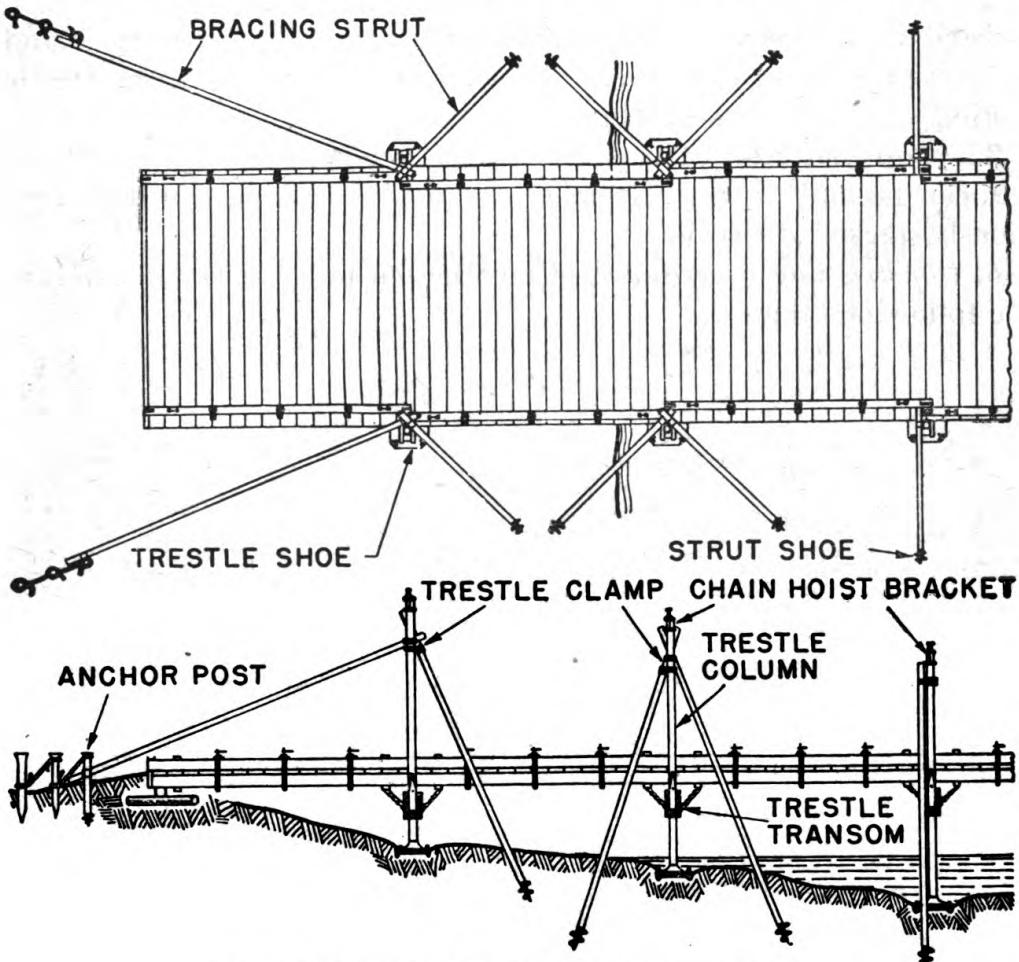


FIGURE 20.—Trestle bracing on unstable foundation.

stream bed, trestles must be used to a point where the water is at least 30 inches deep.

c. Extend the floating bridge. When trestle spans are utilized to increase the length of the floating bridge, they replace the approximately 20-foot abutment span. If all the trestles are used at one end of the bridge, the bridge is extended 55 feet (five 15-foot spans less one 20-foot span). If two trestles are used at each end of the bridge, the bridge is extended 25 feet at each end (three 15-foot spans less one 20-foot span). (See figs. 1 and 21.)

d. Permit the bridge to be reinforced. The 20-foot abutment span of the normal bridge contains 14 ponton balk and cannot have balk

added for reinforcement. Accordingly in the reinforced bridge this abutment span is replaced by two reinforced trestle-balk spans supported on one trestle. (See sec. VII.)

34. Personnel.—Normally, for each near-shore trestle a trestle section of one noncommissioned officer and ten men is added to the bridge construction party. This section erects the near-shore trestle and then crosses the stream and erects the far-shore trestle. It is assisted by the abutment section in erecting and alining the trestle and in erection of trestle bracing. After erection of trestles, the trestle section assists in work on approaches.

35. Construction of trestles.—*a. Unloading and lay-out.*—Trestles can be built directly from trailer loads, or from equipage previously stacked at the site.

b. Construction procedures.—Construction procedures are given in the following table:

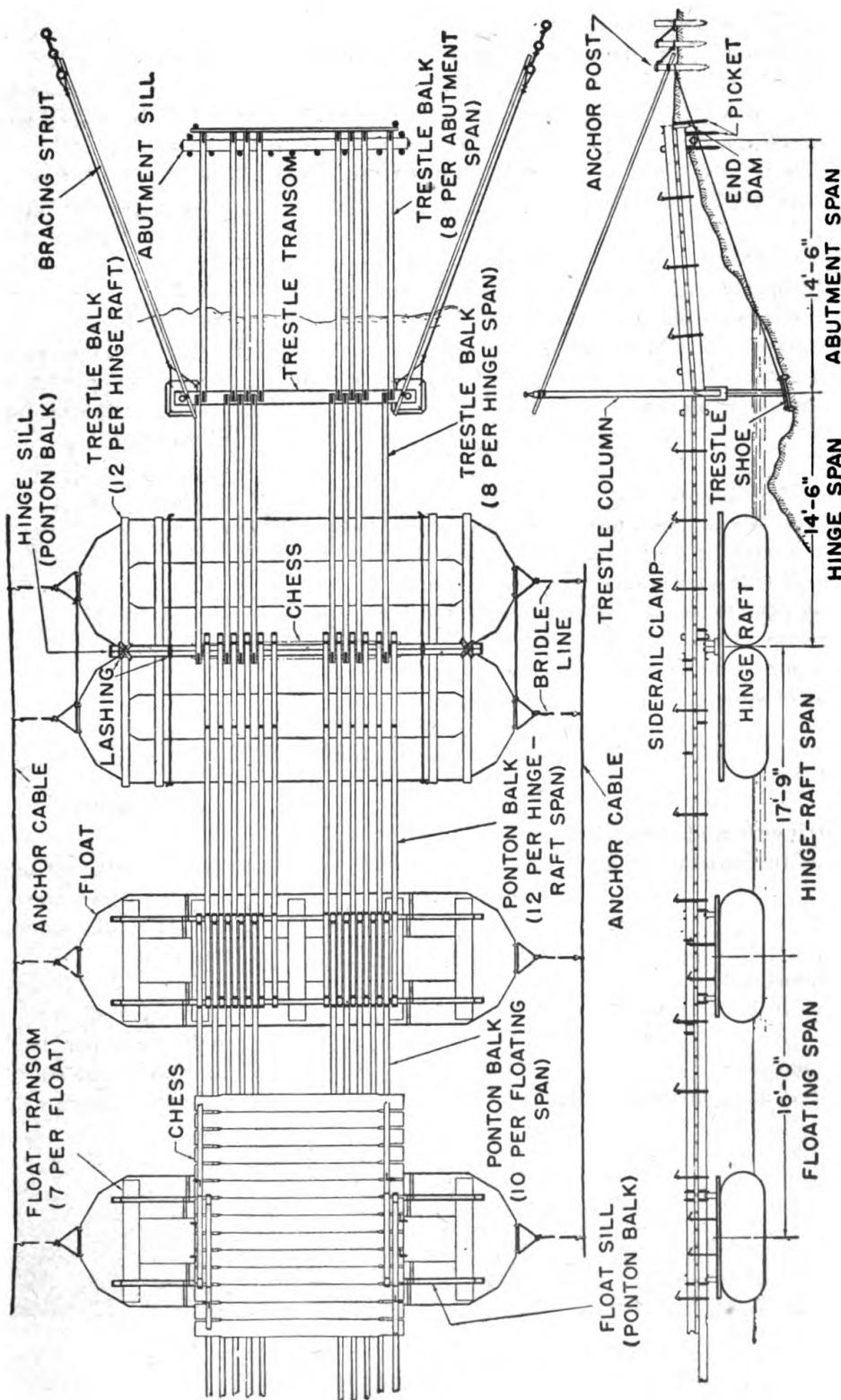


FIGURE 21.—Standard bridge with trestle.

TRESTLE

Task

Equipment

Near-shore trestle erection:

a. Lay transom on its side, insert trestle columns, attach trestle shoes, connect ratchet chain hoists, and attach one bracing strut to each column (fig. 22①). (To prevent shearing connection bolt on clamp during erection of trestle, tighten clamp to snug fit but leave free to turn about column.)

b. Erect trestle, using bracing struts to guide trestle into position (fig. 22②); lay outside balk; aline trestle; place remaining 6 balk.

c. Complete installation of trestle bracing; lash outside balk to transom; adjust height of transom and disengage hoists from transom stirrups.

1 trestle
2 ratchet chain hoists
8 trestle balk (stringers) per span
2 lashings, 20-foot, $\frac{1}{2}$ -inch rope (for outside balk) per span

2 anchor lines with 12 cable clips (for trestle shoes)

Trestle bracing equipment (type depends on character of foundation)

Tools

Far-shore trestle erection:

a. Load trestle equipment (less 6 trestle balk per span) on far-shore hinge raft and cross stream. *Load and unload with care to avoid damage to floats.*

See above

b. Erect trestle on far shore in same manner as near-shore trestle, except that skeleton spans of only 2 balk stringers are constructed; remaining 6 balk being laid with rest of superstructure after closing of bridge gap.

SUPERSTRUCTURE

Task

Equipment

Balk (stringers and siderails):

Laid as in floating bridge.

8 trestle-balk stringers per span (see above)
2 trestle-balk siderails per span

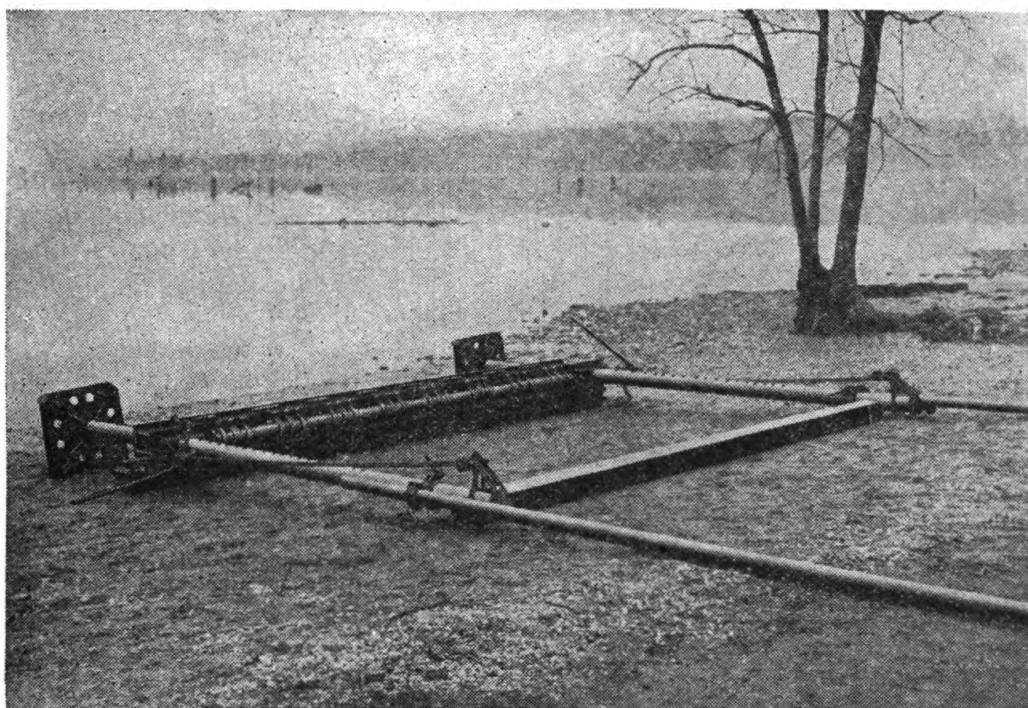
Chess (flooring):

Laid as in floating bridge.

15 chess per span
2 half-chess per trestle and per hinge sill
6 siderail clamps per span

Siderail clamps:

Fastened as in floating bridge.



① Assembly.



② Erection.

FIGURE 22.—Assembly and erection of trestle.

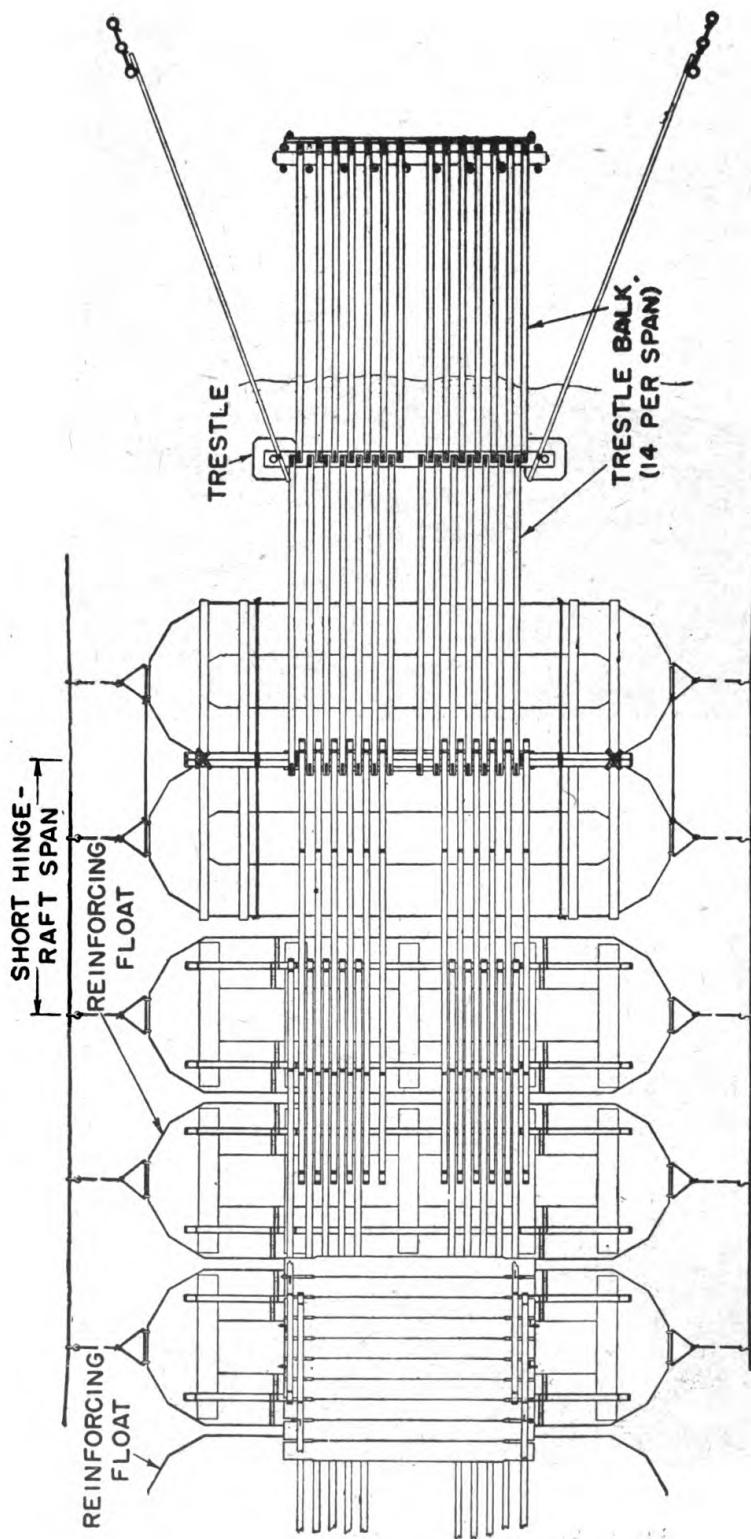


FIGURE 23.—Reinforced pneumatic ponton bridge M3.

SECTION VII

REINFORCEMENT OF BRIDGE

	Paragraph
General	36
Construction	37

36. General.—*a. Design.*—The pneumatic bridge is reinforced by inserting one float assembly in each floating span, shortening the hinge-raft span, and replacing the abutment span with two spans of trestle balk supported by one trestle. (See fig. 23.) Sufficient floats are issued with each unit to construct a full-length reinforced bridge. The bridge may be built reinforced or may be reinforced after the normal bridge has been constructed.

b. Capacity.—The reinforced bridge is tentatively rated to carry an 18-ton tank if stream velocity is low and close control is maintained. The bridge is unsafe for any vehicle when stream velocity exceeds 3.5 miles per hour.

37. Construction.—*a. Floats.*—The reinforcing float assembly is a standard float assembly. It is placed midway between the float assemblies of each floating span. If the bridge is constructed reinforced, two float assemblies at a time instead of one are delivered for each floating span. The reinforcing float assembly is maneuvered under the span after the balk carriers have pushed the riverward float assembly out into the stream, but before they have lowered the shoreward ends of the balk into place. If the reinforcing float assemblies are placed after construction of the standard bridge, the floats are only partially inflated so that the assemblies can be floated into position under the existing spans. The floats are then inflated. Float clamps are fastened and bridle lines are attached in the same manner as in the standard bridge.

b. Hinge-raft span.—The space between floats in the standard hinge-raft span is too short to permit insertion of a reinforcing float. Therefore, the hinge-raft span is shortened to approximately 12 feet by allowing balk in this span to project 6 feet beyond the riverward sill of the riverward float. (See fig. 23.)

c. Trestles.—The 20-foot abutment span of the normal bridge, containing fourteen ponton-balk stringers, cannot be reinforced by adding balk. Accordingly in the reinforced bridge two spans of fourteen trestle balk supported by a trestle are substituted for the abutment span. Reinforcement of an existing bridge increases the length of the bridge 4 feet at each end. Shifting of the bridge may be avoided by moving each abutment sill inland 4 feet.



① Raft ready to load.



② Loaded raft.

FIGURE 24.—Loading of reinforced raft.

SECTION VIII

RAFTS

	Paragraph
General	38
Construction	39
Personnel	40

38. General.—*a. Design.*—Rafts may be built with spare floats, special balk connectors, and balk, chess, and siderail clamps from the trestle bridge. To construct a fully reinforced raft, four standard float assemblies are lashed together and used to support the decking. The decking is constructed of chess laid on twelve stringers, each consisting of three trestle balk joined end to end by balk connectors (figs.

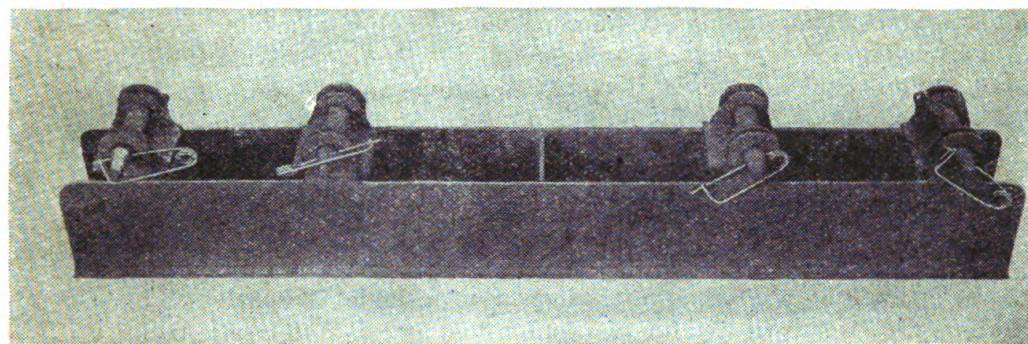


FIGURE 25.—Balk connectors.

24, 25, 26, and 27). Decking is clamped to the float assemblies in the same manner as in the normal bridge. To construct a lightly reinforced raft, the same decking is laid on three float assemblies (spaced to prevent a damming effect in currents) and the raft is reinforced by laying two additional trestle balk joined by a balk connector on each side of the roadway. These reinforcing balk are placed across the float sills above the outer float transoms, and the reinforcing balk, float sill, and float transom are clamped together near each junction.

b. Capacity.—The fully reinforced raft can carry an 18-ton tank if stream velocity does not exceed 1.7 miles per hour. The lightly reinforced raft can carry a loaded 4-ton truck in currents up to 3.5 miles per hour.

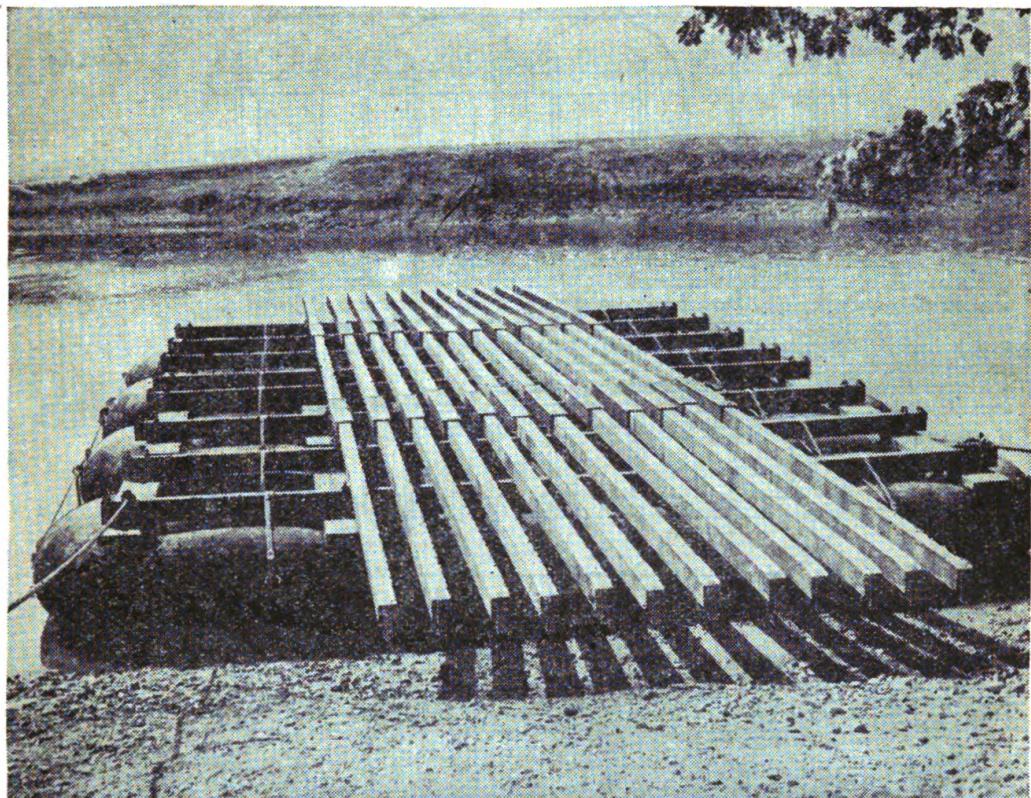
39. Construction.—Construction procedure is given in the following table:

REINFORCED RAFT

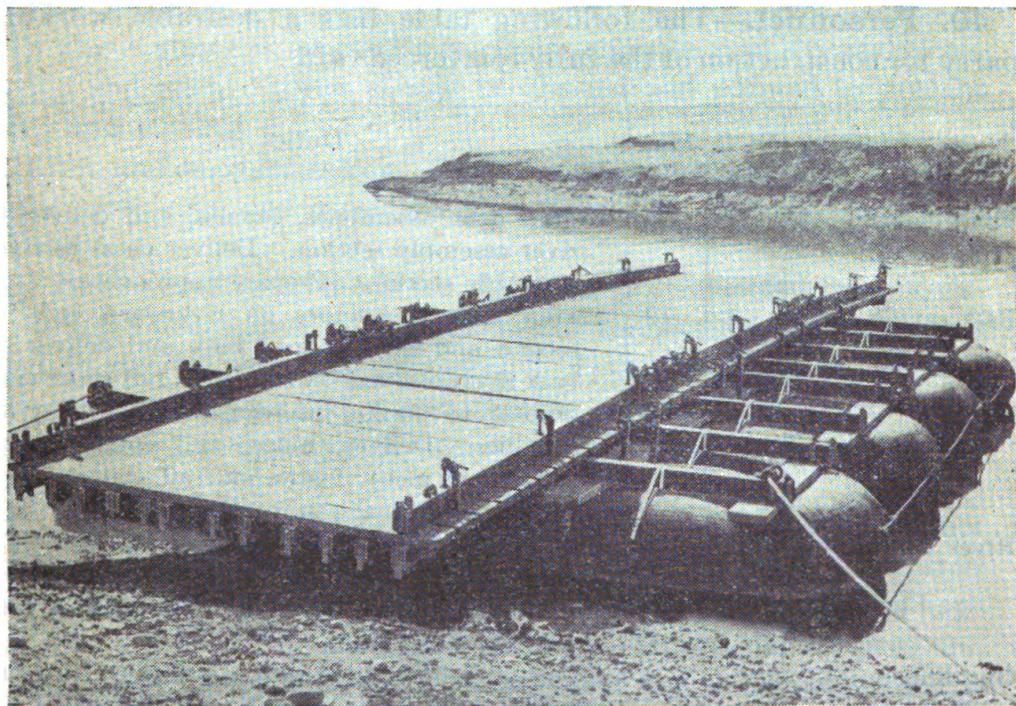
<i>Task</i>	<i>Equipment</i>
a. Obtain and launch two standard float assemblies.	4 float assemblies
b. Lash the two float assemblies together, and place twelve trestle balk across the four float sills.	42 trestle balk (12 stringers and 2 side-rails per bay)
c. Attach guy lines and moor floats in position.	28 balk connectors
d. Attach balk connectors to riverward ends of second set of twelve trestle balk and connect end to end with first set of balk.	46 chess
e. Raise shore ends of second set of balk, push float assemblies out into river, insert a third float assembly, and lash it to center float.	34 siderail clamps (6 per bay; 4 per float)
f. Turn raft about, add third set of trestle balk with connectors attached, and insert fourth float assembly in the same fashion.	6 lashings, 10-foot, $\frac{1}{2}$ -inch rope
g. Lay chess and siderails; fasten siderail clamps and float clamps.	4 guy lines Pickets Shovels Axes Brush hooks Paddles

LIGHTLY REINFORCED RAFT

<i>Task</i>	<i>Equipment</i>
Same as for fully reinforced raft, except that a single float assembly is substituted for two center float assemblies and that additional reinforcing balk are laid across float sills above outer float transoms and are clamped to float transoms by siderail clamps.	3 float assemblies 46 trestle balk 30 balk connectors 46 chess 42 siderail clamps (6 per bay; 8 per float assembly) 4 guy lines Tools as for reinforced raft



① Raft with balk in place.



② Raft completed.

FIGURE 26.—Construction of reinforced raft.

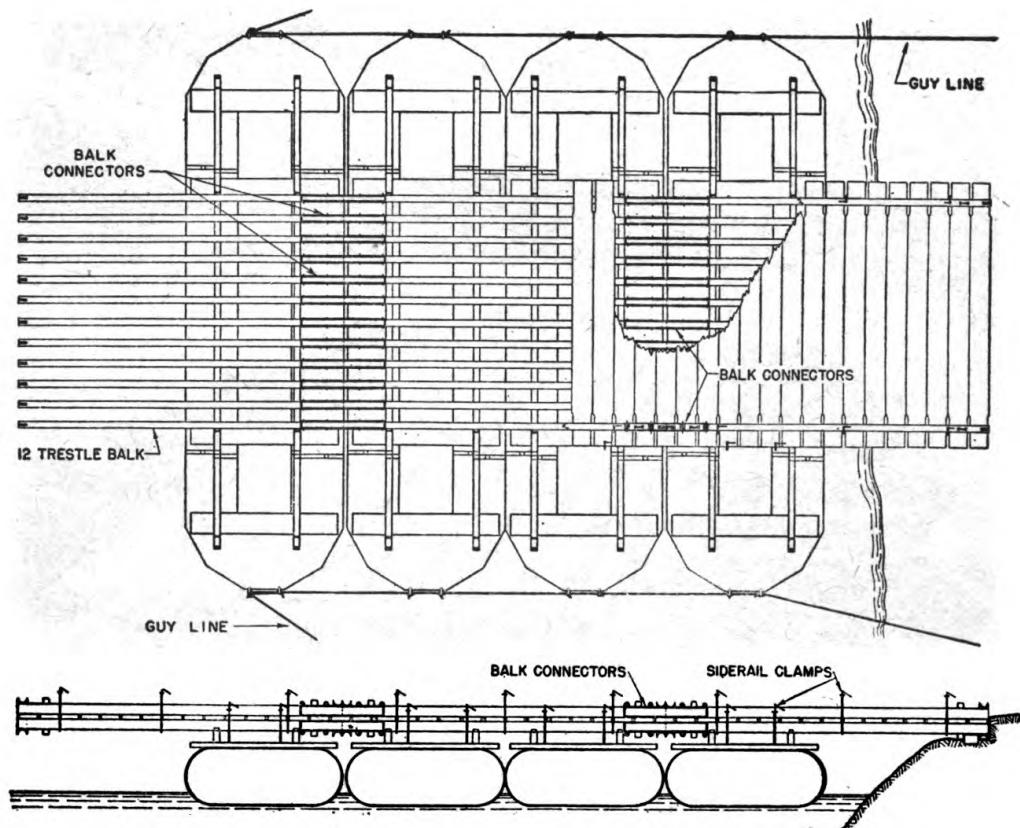


FIGURE 27.—Construction of reinforced raft.

40. Personnel.—The following table lists a desirable working party for construction of the fully reinforced raft.

Name of section	NCO	Men	Duties
Float carrier-----	1	16	Obtain float assemblies, launch, and deliver to river assembly section. Deliver chess to river assembly section. Prepare approaches.
Balk carrier-----	1	12	Fasten balk connectors on riverward ends of second and third sets of balk and deliver all balk to river assembly section. Lift shore ends of balk to permit insertion of outer float assemblies. Deliver, place, and connect siderails (four men); fasten siderail clamps (four men); fasten float clamps (four men).
River assembly--	1	6	Receive and lash together float assemblies. Receive balk with balk connectors attached; place and connect balk. Assist turning of raft. Place chess.
Guy line-----	-----	4	Attach guy lines; hold raft in position; turn raft before addition of last float. Prepare holdfasts.
Total-----	3	38	

SECTION IX

MAINTENANCE

	Paragraph
General maintenance	41
Repairs	42

41. General maintenance.—*a. General.*—(1) Proper care and maintenance of the bridge equipment is necessary to keep it in serviceable condition. This is especially true of the floats, which will not stand abuse.

(2) A regular program of inspection, cleaning, replacement, repair, and painting should be adhered to. It is especially important that all parts be carefully inspected and preventive measures taken against deterioration when the equipment is not being used.

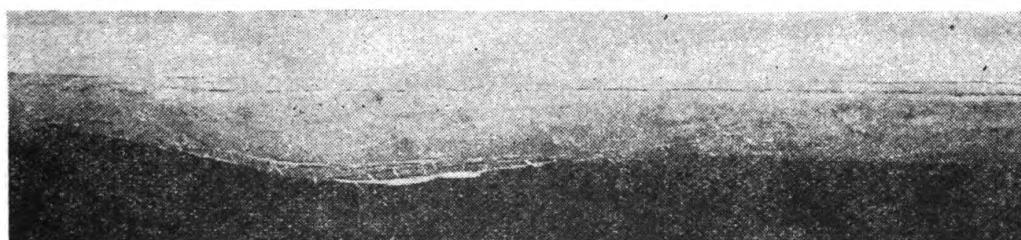


FIGURE 28.—Effect of mildew on fabric of a float.

(3) The equipment, especially the floats, must be kept dry and clean. Wooden and metal fittings should be cleaned and painted to prevent rotting and rusting.

b. Care and maintenance of floats.—*The rubberized canvas floats require more care and attention than any other part of the bridge equipment.*

(1) Before rolling up floats for storing or for extended transportation, inflated floats must be cleaned, aired, and sunned for a sufficient period to dry all portions completely. Floats must not be allowed to become covered with dirt and foreign matter. The central tube must be taken out and any dirt or stones on the floor of the float removed.

(2) Any material which holds moisture and which is in contact with the tubes of the float will cause mildew to form in the cotton fabric. Mildew causes the fabric to lose its strength; when this happens, only a thin rubber coating is left to withstand the air pressure, and the sides of the float will bulge and burst before normal inflation pressure is reached. The effect of mildew on a float is shown in figure 28.



① Folding outer tubes upon central tube.



② Rolling up folded float.

FIGURE 29.—Preparing deflated float for insertion into carrying case.

(3) Since excess sunlight deteriorates the rubber, floats must not be stored in the sun; they are placed there only long enough to dry. Floats are stored inside their carrying cases.

(4) Floats must not be placed upon, or dragged over, sharp objects. A float is carried by at least 12 men. Movement of the float is best accomplished when it is either inflated or contained in the float carrying case.

(5) The float is deflated before it is inserted into the carrying case. The inflation manifold should be used to deflate the floats completely. The outer tubes are then folded upon the central tube to reduce the

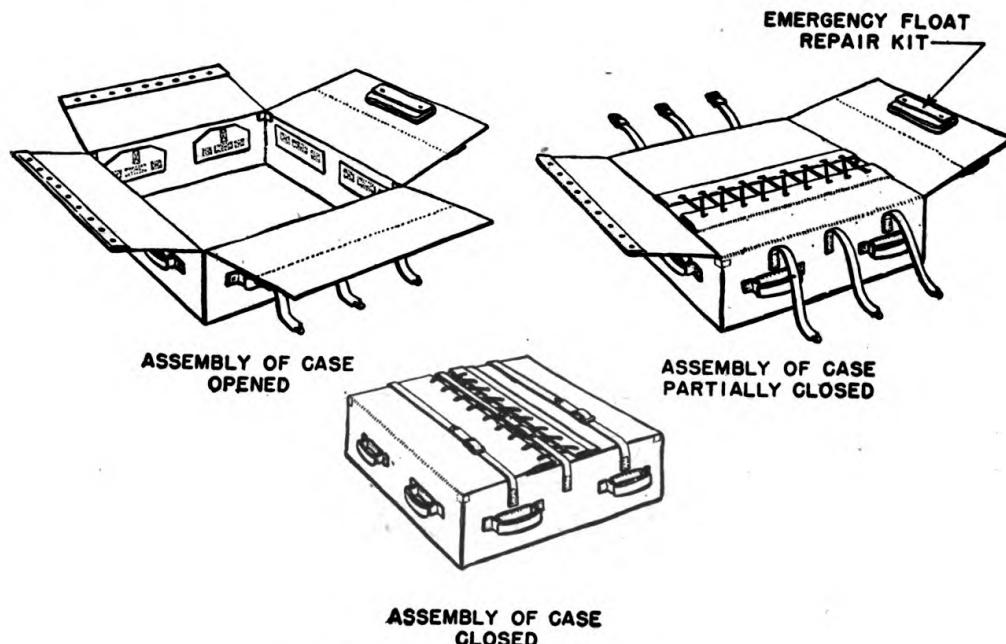


FIGURE 30.—Float carrying case.

width of the rolled float (fig. 29). The float is then placed inside the opened carrying case and the case is strapped shut (fig. 30).

42. Repairs.—*a. Float repair kits.*—There are two types of float repair kits with the pneumatic bridge. An emergency repair kit is carried in each of the float carrying cases. Five large float repair kits for normal repairs are carried with the transportation of each unit.

(1) *Emergency float repair kit.*—The emergency float repair kit carried in each of the float carrying cases (fig. 31) consists of several valve caps, a small bottle of rubber cement, two small pieces of air-chamber fabric, wooden plugs, and several small tools, including the metal roller, scissors, and scratcher (fig. 32). Repairs to the floats are made with this kit when the larger kit carried on the truck is not available.

(2) *Large float repair kit.*—Each of the five large float repair kits (fig. 31) contains all materials necessary for the repair of pneumatic floats. The kit contains benzine, paint brushes, a wire brush, valve caps, cement, a large piece of rubberized fabric (15 feet long and 32 inches wide), vulcanizing patches, tape, and tools for the repair of floats. All tools are manually operated. Training in the repair of floats is necessary for satisfactory results. Instructions for repair of floats are contained inside the repair kit.

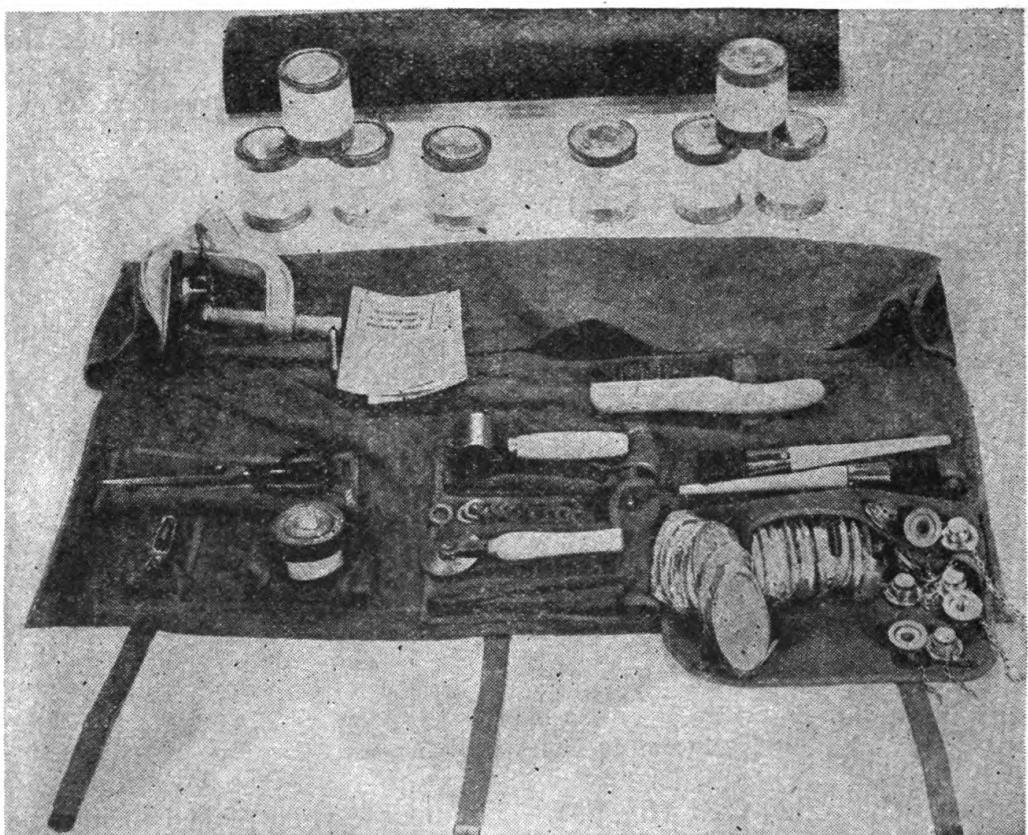


FIGURE 31.—Large float repair kit.

b. Repair of floats.—(1) *Cemented repairs.*—The procedure for making cemented repairs (fig. 32) is as follows:

(a) *Location and enlargement of hole.*—If the hole is too small to see, locate it by painting the surface of the inflated float with soapsuds or by immersing it in water. If the hole is larger than 1 inch in diameter, enlarge it if necessary and expose the inside surface by means of clamps (fig. 32①) to facilitate application of cement and inner tape.

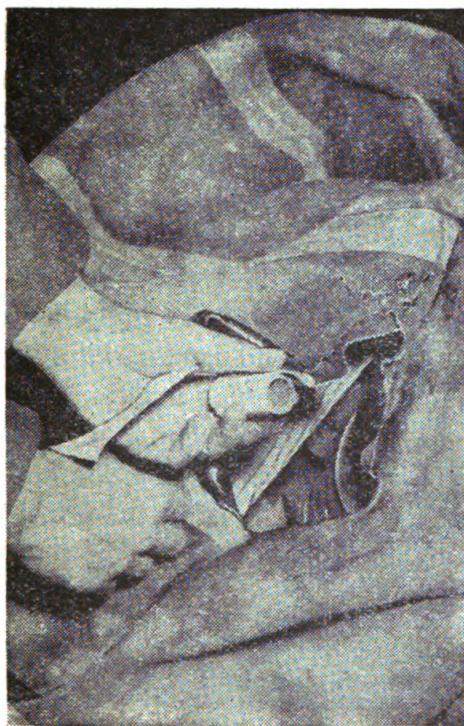
(b) *Preparation of surface.*—Roughen the outside surface of the float (also inside surface, if the hole is large) around the hole with the metal scratcher or with sandpaper; then wash with benzine,



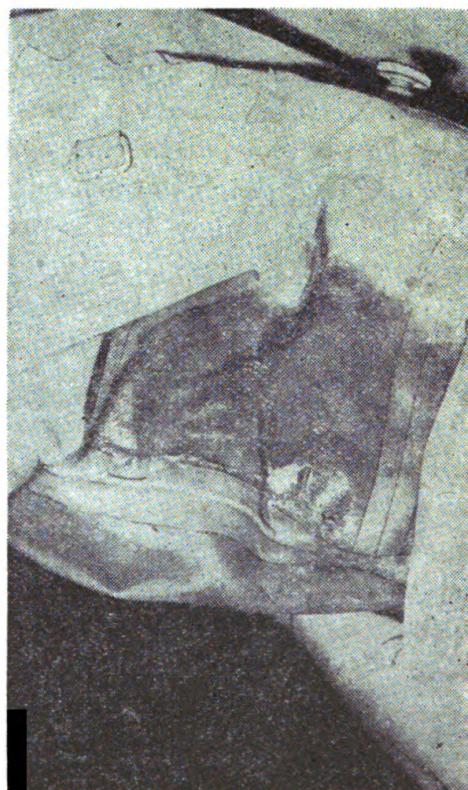
① Tear enlarged and inside surface exposed by means of clamps.



② Apply cement to inside surface.



③ Apply inside tape.



④ Outside patch in place.

FIGURE 32.—Cemented repair.

naphtha, or clear gasoline, and allow to dry for at least 15 minutes. The inside float surface must be dry even when an inside tape is not used.

(c) *Application of inside tape.*—If the hole is larger than 1 inch in diameter, an inside rubberized tape is necessary to prevent leakage through the fabric between the two rubber layers. Apply three or more coats of heavy cement (three parts cement to one part benzine) to an inside surface at least $\frac{1}{2}$ inch larger than the tape to be used (fig. 32②). Allow each coat to dry for at least 15 minutes until it becomes glossy. Remove paper backing from rubberized tape and apply one coat of light cement (one part cement to one part benzine) to make tape tacky. Apply tape (fig. 32③) and remove wrinkles and air pockets by pressing and rolling. Tape and inside cement are not applied in emergency repairs (emergency kits have no tape).

(d) *Application of outside patch.*—To apply outside patch (fig. 32④), give outside surface of the float and one side of the fabric patch three coats of light cement and two coats of heavy cement. Allow each coat to dry as before. Place patch, and remove wrinkles and air pockets by pressing and rolling. Do not inflate to normal pressure for at least 24 hours.

(2) *Hot-patch repairs.*—This method is used to repair holes up to $\frac{1}{2}$ inch by 2 inches (fig. 33). Procedure is as follows:

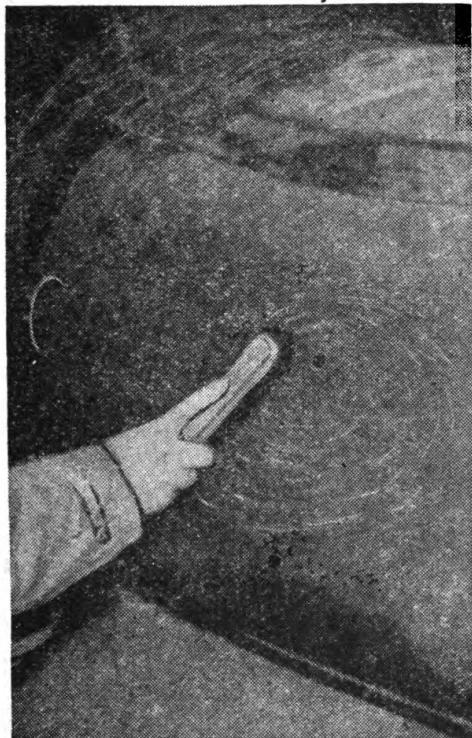
(a) Roughen, wash, and dry float surface, taking care not to cut through the rubber coating; then apply one coat of cement.

(b) Apply hot-patch, clamp it tightly with clamp provided, and light, allowing patch to burn out. Remove clamp after patch is cool.

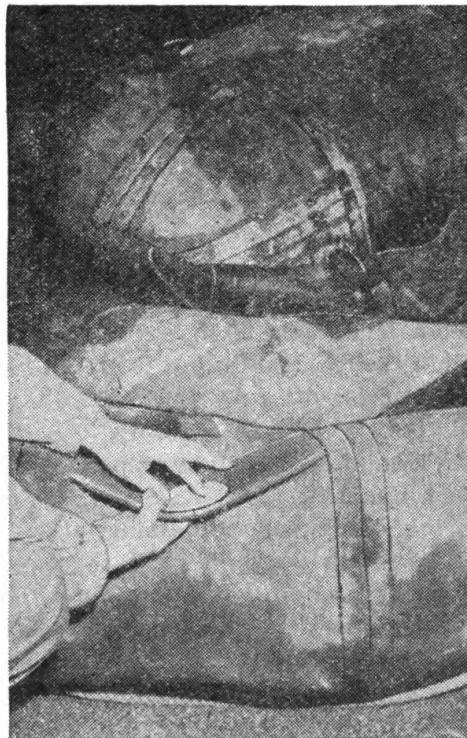
(c) If patch bulges under pressure, it may be reinforced with a fabric patch for strength only.

(3) *Temporary repairs with wooden plugs.*—Tapered wooden plugs $\frac{3}{4}$ inch and $1\frac{1}{2}$ inches in diameter are provided in the emergency repair kits. They will seal holes up to $\frac{1}{2}$ and 1 inch in diameter respectively. The plug is inserted in the hole and turned carefully until tight. Permanent repairs are made as soon as materials and time permit.

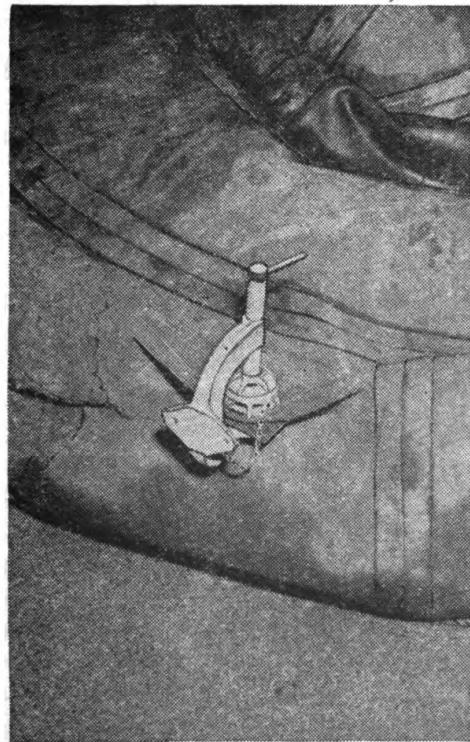
c. *Repair of equipment other than floats.*—The repair of balk, chess, clamps, fittings, and other material of the 10-ton ponton bridge-type equipage is covered in TM 5-273.



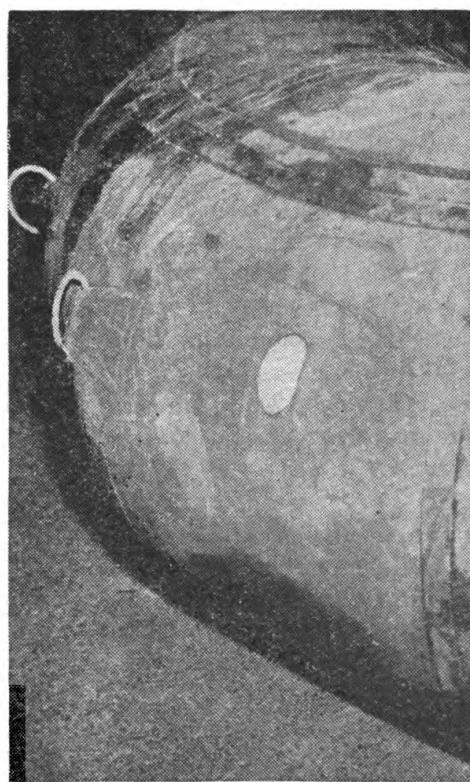
① Roughening float surface with wire brush before applying patch.



② Applying patch.



③ Patch clamped to float surface before burning.



④ Completed hot-patch repair after burning of patch and removal of clamp.

FIGURE 33.—Hot-patch repair.

APPENDIX

LIST OF EQUIPMENT—UNIT OF PNEUMATIC PONTON BRIDGE M3

Article	Basic quantity	Spares	Total quantity
Anchor, Danforth, 30-lb	2	0	2
Anchor, kedge, 100-lb	1 14	1 4	18
Balk, ponton, 4" x 6" x 21.5"	1 220	1 42	262
Balk, trestle, 4" x 6" x 15' 4 $\frac{1}{8}$ "	1 120	1 10	1 130
Boat, assault, M2, with seven paddles in canvas carrying case	2	0	2
Bracing, trestle, set, containing—			
Auger, post-hole, 6"	1 2	0	1 2
Block, snatch, $\frac{3}{8}$ " manila rope	4	0	4
Chest, for two ratchet chain hoists	4	0	4
Clamp, column	32	0	32
Clamp, column, spares:			
Bolt	0	6	6
Nut and handle, assembled	0	6	6
Clip, wire rope, $\frac{1}{2}$ "	1 48	1 16	1 64
Grip, cable, $\frac{1}{2}$ " wire rope	4	0	4
Hoist, ratchet, chain, 1 $\frac{1}{2}$ - to 3-ton	8	0	8
Pin, strut shoe	16	3	19
Post, anchor	1 4	0	1 4
Rope, wire, $\frac{1}{2}$ ", 6 x 19 plow steel (250' on spool); feet	500	0	500
Shoe, bracing strut	16	0	16
Strut, bracing, 2 $\frac{1}{2}$ " x 22'	16	0	16
Wrench, open-end, adjustable single head, 10" (crescent)	4	0	4
Bracket, reflector, ponton balk type	64	16	80
Buoy, life	6	0	6
Case, canvas, 12-ton pneumatic float, with emergency repair kit containing	29	11	40
	(per float)		(total 40 floats)
Cap, valve, Schrader	4		160
Cement, bottle, 2-oz	1		40
Fabric, air chamber, pieces 1' sq	2		80
Plugs, wooden, $\frac{3}{4}$ " x 3"	4		160
Plugs, wooden, 1 $\frac{1}{2}$ " x 3"	4		160
Roller, metal, 1" diam., 1" long	1		40
Scissors, 6"	1		40
Scratcher, metal	1		40
Washer, valve cap, Schrader	10		400
Chess	325	15	340
Chess, half	1 13	1 2	1 15

¹ Tentative.

PNEUMATIC PONTON BRIDGE, M3

Article	Basic quantity	Spares	Total quantity
Chest, for 2 ratchet chain hoists	1	0	1
Clamp, siderail	1 214	1 11	1 225
Clip, wire rope, $\frac{1}{2}''$	1 12	1 12	1 24
Compressor, air, portable	2	0	2
Connector, balk, complete	56	4	60
Connector, balk, spare parts:			
Chest, spare parts	0	1	1
Pins, safety	0	60	60
Pins, shoe	0	60	60
Shoe, balk connector	0	60	60
Flare, road, electric	1 48	1 16	64
Float, pneumatic, 12-ton	29	11	40
Grip, cable, $\frac{1}{2}''$ wire rope	1 4	0	1 4
Hoist, chain, ratchet	2	0	2
Hold-fast, complete with 9 steel pickets	4	1	5
Hook, boat, ball-point, 10'	12	0	12
Kit, repair, pneumatic float, complete with the following:	5	0	5
	(with each kit)		(total 5 kits)
Benzine, can, 1-pt., screw-top	4	-----	20
Brush, paint, type 1, size 3	2	-----	10
Brush, wire	1	-----	5
Cap, valve, Schrader	20	-----	100
Cement, can, 1-pt	4	-----	20
Fabric, air chamber, piece $2'8'' \times 15'$	1	-----	5
Knife	1	-----	5
Pliers	1	-----	5
Patches, vulcanizing, No. 4	25	-----	125
Roller, metal, flat, ball-bearing $1\frac{1}{2}''$ diam., with $1\frac{1}{8}''$ face	1	-----	5
Shears, steel, forged	1	-----	5
Stitcher, ball-bearing, $2\frac{1}{2}''$ diam., $\frac{1}{32}''$ face	1	-----	5
Tape, rubberized, 2" wide, 10-yd. roll	1	-----	5
Vulcanizer, universal, No. 6 (C-clamp)	1	-----	5
Washer, valve seat, Schrader	40	-----	200
Lamp, flasher, electric	15	0	15
Lamp, rescue and debris, portable electric	1	1	2
Light, bridge inspection	2	1	3
Line, bridle, $\frac{1}{2}''$ manila rope, 50 ft., with snap	60	20	80
Manifold, inflation, 4-hose	2	1	3
Manifold repair parts, consisting of—			
Clamp, hose	0	6	6
Hose	0	2	2
Nipple, hose	0	4	4
Nozzle assembly, complete	0	3	3
Seal, valve stem	0	6	6

¹ Tentative.

CORPS OF ENGINEERS

Article	Basic quantity	Spares	Total quantity
Motor, outboard, 22-hp., complete with chest, accessories, operating tools, and repair parts	4	0	4
Paddle, assault-boat, complete with carrying case (seven per case)	56	14	70
Picket, steel, $1\frac{1}{4}$ " diam., 3' 6" long	32	32	64
Pole, range, 6', two-section; with carrying case	14	11	15
Rigging set, with chest	1	0	1
Rope, manila, $\frac{1}{2}$ " feet	4,800	0	4,800
Rope, manila, $\frac{3}{4}$ " feet	3,600	0	3,600
Rope, manila, 1" feet	2,400	0	2,400
Rope, wire, $\frac{1}{2}$ ", 6 x 19 (500' on spool) feet	1,000	0	1,000
Sill, abutment (10-ton), $5\frac{1}{4}$ " x $7\frac{1}{4}$ " x 13'0"	4	0	4
Tape, metallic, 50'	2	0	2
Transom, float, lumber, 3" x 12" x 77', S4S	175	20	195
Trestle, complete (without hoists)	4	0	4
Trestle spare parts:			
Transom pin and chain	0	4	4

¹ Tentative.

[A. G. 062.11 (2-27-43).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIQ,
Major General.
The Adjutant General.

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(For explanation of symbols see FM 21-6.)

